NAVAIR 50-1D-1

FEDERAL METEOROLOGICAL HANDBOOK No. 1

Surface Observations

Supersedes Seventh Edition
of WBAN Circular N

Change No. 1 to AD698884

Effective January 1, 1971

U.S. DEPARTMENT OF COMMERCE
U.S. DEPARTMENT OF DEFENSE
U.S. DEPARTMENT OF TRANSPORTATION
Washington, D.C.

Change 1 (January 1971), Federal Meteorological Handbook Number 1-Surface Observations.

Orientation Preface

The most significant items in this change are as follows:

Chapter A2: ¶1.8.1. (WB, FAA) Changes period of retention of MF1-10s at FAA, SAWR, A and SA-type stations from 90 days to 30 days.

¶3.4. Changes period of observation to the 15 minutes prior to the actual time of observation.

¶3.7.3. Deletes the requirement for taking a local observation when in-flight emergencies are declared.

Chapter A3: Table A3-4. Changes procedure for using "+" sign with visibilities.

¶2.13.2d. Now applies to all agencies.

¶2.13.3a. (WB, FAA) Changes period during which RVRNO must be transmitted.

¶2.13.4. Remark for amount of obscuration now required at all stations.

¶2.13.7. Changes time period for including pilot and radar reports in remarks from 20 to 15 minutes.

¶2.13.8a(6). Redefines the use of variable sky condition remarks.

¶2.13.8c(2a). Redefines requirement for reporting thunderstorm remarks.

¶2.13.8e(1). Changes reporting procedure for peak wind speeds.

¶2.13.8e(2). Defines procedure for reporting variable wind direction in remarks.

¶2.13.9c. (WB) Changes dissemination time of water equivalent of snow on ground to 1800 GMT daily.

¶2.13.10. Changes procedure for reporting freezing level data to provide for multiple crossings.

¶2.13.11 (AF, N) Instruction expanded to include dissemination procedures.

¶2.18. (WB, FAA, N) Changes requirement for recording dry-bulb temperature in column 18.

¶2.19. (WB FAA, N) Changes requirement for recording wet-bulb te perature in column 19.

¶2.46. Now applies to all agencies. Item c restates procedure for recording melting precipitation in column 46.

¶2.73. Changes procedure for recording the times of multiple occurrences of peak wind speeds in column 73.

¶2.68f. (AF) Changes procedure for entering estimated amounts of snowfall.

¶2.80. Changes the time of determining the water equivalent of snow on the ground to 1800 GMT.

¶2.90d. Clarifies requirement for recording time checks in block 90.

¶2.90.4. (AF) Changes requirement for recording the active runway in block 90.

¶2.90.5 (WB, FAA) Clarifies requirement for recording comparisons of aneroid instruments in block 90.

Chapter A4: ¶4.1.3. Now applies to all agencies.

¶4.5.1c. Prescribes the use of the actual time of all observations when disseminated over telewriter.

¶4.5.2c. (AF) Deletes the requirement to enclose PA data in parentheses.

¶4.10. Clarifies use of FIBI with record observations.

Chapter A5: ¶2.5.5. Redefines "radar" ceilings.

¶2.22. Defines variable sky condition.

¶2.26. Redefines Radar Cloud Detection Report.

¶3.7.3g and h. Redefines use of radar cloud heights as estimated heights.

¶3.7.5. Changes use of "radar" ceiling classification.

Chapter A6: ¶3.5. Changes procedures for reporting estimated visibilities beyond 7 miles.

Chapter A7: ¶3.2.4. Restates procedures for reporting thunderstorm remarks.

Chapter A8: ¶3.5.6. (AF, N) States procedure for computing density altitude.

¶4.3. (WB, FAA) Restates procedure for using aircraft-type altimeters.

Chapter A10: ¶2.5. Redefines a gust.

¶2.6. Redefines a squall.

Chapter A11: ¶5.1. (AF) Establishes provision for forecaster evaluation of all PIREPS prior to local dissemination except those received by the ROS observer.

Chapter A12: ¶2.2. Changes period of ceilometer operation.

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CHAPTER A1. INTRODUCTION

CHAPTER A1

INTRODUCTION

1. Purpose. This handbook prescribes uniform instructions for standard weather observing and reporting techniques. It is intended to provide a framework within which the observer can find a system for identifying meteorological phenomena and reporting their occurrence in an understandable format. Agreements with the World Meteorological Organization, international and domestic aviation interests, and civil and military weather services provide the basis for which standards are developed.

1.1 Observational Procedures. In this handbook, procedures are based upon the premise that routine weather evaluations are taken in accordance with established schedules for "record" observations and that nonroutine weather evaluations are made whenever it is noted that certain elements change to above or below prescribed values for "special" or "local" observations. Weather observations recorded on Meteorological Form 1-10 (MF1-10) and reported by observing stations reflect only those conditions observed at or seen from the usual point-of-observation and within approximately 15 minutes prior to the times inscribed on MF1-10 or transmitted within the report, unless otherwise specified in this handbook.

2. Procedures Not Applicable to All Stations. Some instructions in this handbook are preceded by abbreviations in parentheses. These instructions apply only to the stations represented by the abbreviations as follows:

(N)	Naval Weather Service
(AF)	Air Weather Service
(WB)	Weather Bureau
(FAA)	Federal Aviation Administration

Instructions designated for the Weather Bureau (WB) are applicable to Cooperative and Paid Aviation Weather Reporting Stations (A-Type Stations), Paid Synoptic Weather Reporting Stations (S-Type Stations), and Supplementary Aviation Weather Reporting Stations (SAWRS). Those designated for the FAA are applicable to Flight Service Stations (FSS), Limited Aviation Weather Reporting Stations (LAWRS), and the Coast Guard.

3. Changes to the Handbook. Corrections, deletions, additions and similar modifications will be issued as necessary under the titles "CHANGE NO. 1, 2, 3, etc.". These changes will be issued by the Weather Bureau after consultation and coordination with the agencies listed under authority in the Preface to this handbook. A change may consist of from a few pages to whole sections of the handbook. These pages will replace or expand portions of the handbook and in each case a cover sheet (Orientation Preface) will indicate the actions to be taken. In the handbook changes, new text which alters previous procedures, will be indicated by an asterisk in the left margin adjacent to the first word of each paragraph affected.

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* 3.1 Agency Procedural Changes. Procedure changes may be issued individually by each agency for use within the issuing agency whenever necessary to meet urgent requirements. These changes may be identified as appropriate to the practices of the individual agency. Agency changes, including material of general interest, will be consolidated into future handbook changes when desired by the agency concerned.

4. Supplements. This handbook may be supplemented by instructions issued separately by the Weather Bureau, Army, Navy, or Air Force. These instructions will be followed by the agency issuing the supplement.

* 5. Maintaining the Handbook. The user of this handbook may remove or otherwise indicate any portion that is not applicable to his particular mission so as to have a working handbook for quick reference by the observer. A master copy of the handbook, complete with appropriate agency changes and supplements, will be maintained at each observing station for reference purposes. When inserting changes in the handbook, enter the number, effective date, pages affected, initials, and date entered on page ii of the handbook.

6. Unforeseen Requirements. No set of uniform standards can cover all of the possibilities in weather observing. The observer shall use his own judgment, considering the purpose of his mission, to adequately describe that phenomenon which he sees whenever the situation at hand is not adequately covered by specific instructions. In an occasional unusual or unforeseen situation not provided for herein, the observer, in the exercise of sound professional and technical judgment, may perceive that procedures differing from those set forth in this handbook are required for observation and recording of accurate weather data. Under such circumstances, the observer should follow his professional and technical judgment, adhering to the provisions of this handbook as closely as may be practicable under the circumstances. On the other hand, if an observer feels that a procedure set forth in this handbook is inappropriate for the circumstances for which it is prescribed, he should nevertheless routinely follow it and either suggest a change to this handbook, or clarification of the procedure, using established administrative channels, to the headquarters of the appropriate supervising organization.

* 7. Certification of Observers. Prior to assuming full responsibility for taking surface observations each observer must be certified in accordance with instructions issued by the responsible agency.

8. Observer Responsibility. Observers are expected to be alert to situations conducive to significant changes in weather conditions and to take and disseminate special and local observations as rapidly as feasible whenever changes are noted that meet the criteria specified in chapter A2.

8.1 (WB,FAA) Weather Watch at Civil Stations. In general, observers at airports for civil aviation do not maintain a continuous watch for all changing weather conditions, except that a continuous weather watch will be maintained at stations specifically designated by separate instructions from the Weather Bureau Headquarters to perform this service.

* 8.2 Instrumental Evaluations. When the observer has reason to believe that the accuracy or validity of indications from meteorological equipment is questionable, he should discontinue the use of such equipment until necessary corrective maintenance has been accomplished if required.

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CHAPTER A2

GENERAL PROCEDURES

1. General.

1.1 Content. This chapter explains the various types of surface weather observations, and prescribes practices for taking and recording them.

1.2 Surface Weather Observing Station. For purposes of taking meteorological observations, the location of the station is defined as the point or points at which measurements are taken of the various elements in the observation. In cases where all measurements are taken at approximately the same point a station will be regarded as having a single location. In cases where the various sensors are located so as to obtain acceptable exposure, the station location will be regarded as varying with respect to the individual elements in the observation. For example at a large modern airport the station location may be somewhat as follows:

a. With respect to visually observed elements, such as clouds, prevailing visibility, weather or obstructions to vision, the station location might be immediately adjacent to the weather station office;

b. With respect to temperature, dewpoint, and wind the station location might be the center of the runway complex;

c. With respect to cloud height and ceiling the station location might be a point near an approach end of a runway.

1.2.1 Multiple Observing Locations. Normally, multiple locations will be confined to an area within about two miles of the station location. Weather reports may also contain information on phenomena occurring at other than the location of the station, such as "clouds over mountains NW," "lightning SE," "showers W," etc. In cases of, or reports of, distant phenomena this concept of multiple station locations will not be extended to include points where the distant elements are occurring.

*1.2.2 (AF) Multiple Instrumentation. When the cloud height or wind equipment on the active runway is inoperative and comparable equipment is available for an alternate runway, this equipment may be used provided, in the judgment of the observer, measurements are considered representative of conditions an aircraft will encounter during landing, approach, or takeoff.

1.3 Accuracy of Time in Observations. The accuracy of the actual time of observations and time checks on recording charts is of the utmost importance in aviation safety investigations. One particular clock should be designated as the station standard and a routine procedure set up to assure its accuracy on either a daily basis at part-time stations or on a shift basis at full-time stations.

1.4 Disposal of Insignificant Figures. When computations require that a number be rounded, disregard algebraic signs and observe the following procedure:

a. If the fractional part to be disposed of is one-half or greater, the preceding digit will be increased by one;

b. If the fractional part to be disposed of is less than one-half, the preceding digit will remain unchanged.

Examples: 1.5 = 2, -1.5 = -2, 29.248 = 29.25.

c. An exception to this procedure is in the reporting of cloud heights and visibility. When the actual value of a cloud height, or the visibility falls midway between two reportable values, report the lower of the two values.

1.5 Observation Form. MF1-10, formerly WBAN Form 10, is used to compute and log the various elements in an observation. After completion of all required entries and computations, MF1-10 is forwarded to the archives as the basic record of surface observations taken at the indicated station.

* 1.6 Preparation of MF1-10. Prepare an original and at least one carbon copy of MF1-10. Except as indicated in 1.6.1, start a new page each day with the first observation for that calendar day.

1.6.1 (WB, FAA) Entry of Data for More Than One Day. SAWR, LAWR, and A and SA stations may enter data for more than one day on the same sheet, separating data for different days by a line containing the day, month and year of the data which follow it.

1.7 Disposition of MF1-10.

* 1.7.1 (WB, FAA) Disposition. At 1st Order Weather Bureau and Flight Service Stations, mail original copy of forms to National Climatic Center (NCC) as follows:

a. On the 11th day of each month, or the first working day thereafter, all MF1-10s for the 1st through the 10th of the month;

b. On the 21st day of each month, or the first working day thereafter, all MF1-10s for the 11th through the 20th of the month;

c. By the 2nd of each month, or first working day thereafter, all MF1-10s for the 21st through the last day of the preceding month, together with all associated recorder records.

If an original must be retained on station due to pending litigation, send a copy of the MF1-10 to NCC and include a note explaining the missing original. When the original of the form becomes available, forward it to NCC.

1.7.2 (WB, FAA) Disposition. At SAWR, LAWR, A and SA-Type Stations mail MF1-10s for the past month by the 2nd working day of the current month to the designated office. This office will then verify the observation forms and forward the records to NCC, via the office certifying the payroll when appropriate.

1.7.3 (AF, N) Disposition. Forward original copies of MF1-10s in accordance with the appropriate agency instructions.

* 1.8 Retention of MF1-10 Carbon Copies. Retain carbon copies of MF1-10 on which corrections have been entered as a station record.

* 1.8.1 (WB, FAA) Retention. FAA, SAWR, A and SA-Type Stations shall retain the carbon copies for 30 days unless other action is requested.

2. Definitions.

2.1 Surface Weather Observation. An evaluation of one or more meteorological elements that describes the state of the atmosphere at the location where the observation is taken.

2.2 Actual Time of Observation. The time the last element of the observation is observed or evaluated.

2.3 Standard Time of Observation. The hour to which a record observation applies.

2.4 Local Standard Time. A time based on one of the 24 standard time zones of the globe. The zone in use is determined by the geographic location of the station, therefore, is not subject to change.

2.5 Aircraft Mishap. An inclusive term to denote the occurrence of an aircraft accident, incident, or in-flight emergency which could adversely affect the safety of the aircraft.

2.5.1 (AF) Aircraft Mishap. Includes nonflight aircraft accident when weather is a possible factor, and includes accidents occurring inflight or when an intent for flight exists.

* 2.6 Unofficial Weather Reports. A report of one or more weather elements made by an individual who is not certified nor otherwise exempt from the need to be certified to take observations, e.g., pilots on the ground, law enforcement agencies, etc. These unofficial reports provide additional and supplemental information that is of possible interest to the public and to aviation. These reports are supplemental to that available in official observations or that pertains to locations from which official observations are not available, e.g., identify tornadic activity, reports from unofficial sources, etc.

3. Observing Practices.

3.1 Time. All items are made with reference to the 24-hour clock; e.g., 1:48 a.m. is referred to as 0148 and 1:48 p.m. is referred to as 1348. The time 0000 and 2359 indicates the beginning and the ending of the day respectively.

3.2 Time Standards. Times used in aviation weather observations are with reference to:

a. Local Standard Time (LST), or

b. Greenwich Mean Time (GMT).

3.3 Order of Observing. Elements having the greatest rate of change are evaluated last. When conditions are relatively unchanging, evaluate the elements in the following order:

a. Elements evaluated outdoors

b. Elements evaluated indoors

c. Pressure.

*3.4 Time of Beginning. Insofar as possible, elements shall be observed not more than 15 minutes prior to the actual time of the observation.

3.5 Observation of Elements. Observe and evaluate weather elements as often as is necessary to maintain the station observing program. Use all appropriate equipment to evaluate the present and past weather.

3.5.1 Dark Adaptation. When taking obeervations at night, allow sufficient time for the eyes to become adjusted to the darkness.

3.6 Synoptic Observation. Synoptic observations are designed primarily for use in weather analysis and prediction. These observations are taken by designated stations at 0000, 0600, 1200 and 1800 GMT and entered on MF1-10 on the lines following the record observations for the same time, disregarding columnar headings. Instructions pertaining to synoptic observations and codes are given in the "Federal Meteorological Handbook #2, Synoptic Code."

3.7 Aviation Observations. Aviation observations are classified according to their purpose as described in the following paragraphs.

3.7.1 Record Observations "R". Record observations are a complete aviation observation usually taken hourly when observer personnel are on duty. The contents of record observations are given in table A2-1 The record

Table A2-1. Content of Aviation Observations

Element(s)	Type of Station							
	Manned by observing personnel			Automatic Meteorological Observing Station (AMOS)				
				Observing personnel on duty (manned/automatic status)			Unmanned or personnel off duty	
	Type of observation			Type of observation			Type of observation	
	R&RS	S	L	R&RS	S	L	R&RS	S
(1) Ceiling and Sky	X	X	See paragraph 3.7.3	X	X	See paragraph 3.7.3		
(2) Prevailing Visibility	X	X		X	X			
(3) Weather & Obstructions to Vision	X	X		X	X			
(4) Sea-Level Pressure	X			X	X		X	X
(5) Temperature	X			X	X		X	X
(6) Dewpoint	X			X	X		X	X
(7) Wind Direction, Speed and Character	X	X		X	X		X	X
(8) Altimeter Setting	X	X		X	X		X	X
(9) Cumulative Precipitation for 6-hr. period ending at 00, 06, 12 and 1800 GMT				X			X	X
(10) Remarks, as appropriate	X	X		X	X			

1. Items (1), (2) and (3) should be reevaluated, if practicable, prior to dissemination of the observation to insure that these data are current.

2. (WB) Items (1), (2), (3) and Wind Character are appended in "remarks" at manned/automatic stations not equipped with "push-buttons" or a "Digi-switcher."

3. See paragraph 3.7.2.1 for authorized single elements specials.

4. (WB, FAA) Item (4) is not required at LAWR and SAWR stations.

5. (AF) Item (4), included in 3- and 6-hourly observations only.

* 6. (AF) Item (8) is included in all observations except single element specials.

Table A2-2, Transmission Requirements for Coded Remarks

Order and Format of Data Groups	Excepted Agency	Transmitted in the following GMT reports							
		00	03	06	09	12	15	18	21
app			X		X		X		X
app(RR)		X		X		X		X	
(99ppp)		X	X	X	X	X	X	X	X
(Pepn. greater than 0.99 inch)		X		X		X		X	
($1C_LC_MC_H$)	FAA	X	X	X	X	X	X	X	X
($902s_ps_p$) / ($903s_ps_p$)	AF, N, FAA							X	
($904s_ps_p$)		X		X		X		X	
* $T_{n/x}T_{n/x}$	AF NOTES	X		X		X		X	
* ($2R_{24}R_{24}R_{24}R_{24}$)						X			
* $4T_xT_xT_nT_n$	AF, FAA,	X		X		X		X	

1. Groups enclosed in parentheses are coded and transmitted only when weather conditions are appropriate.

2. The 6-hourly portion of this table is applicable only at those stations where synoptic observations are not filed on Service C or a military equivalent.

3. Data groups not in parentheses are always sent by the specified stations except for those groups for which observing facilities are not available.

4. (WB, FAA) The data groups listed are not required in observations at LAWR and SAWR stations. Other civil stations have been authorized individually to omit certain groups or elements.

* 5. (AF) $T_{n/x}T_{n/x}$ group as designated by the parent wing.

observations taken at 0000, 0600, 1200 and 1800 GMT at stations not transmitting synoptic observations include additional data as specified in Table 2-2 and are known as 6-Hourly Observations. The observations taken at 0300, 0900, 1500 and 2100 GMT are known as 3-Hourly Observations and also contain additional information as specified in table A2-2.

3.7.2 Special Observations "S". Special observations are taken at all aviation reporting stations, except designated civil stations. The contents of special observations are given in table A2-1. A special observation is taken and filed for transmission within 15 minutes after the observer returns to duty following a break in hourly coverage if a record observation was not filed during that 15-minute period. In addition, special observations are taken to report significant changes in weather elements as listed below:

a. CEILING. The ceiling forms below, decreases to less than, or if below, increases to equal or exceed:

(1) 3000 feet

(2) 1000 feet

(3) 500 feet

(4) All nationally published minima, applicable to the airport, listed in the Coast and Geodetic Survey (C&GS) Instrument Approach Procedure Charts or Department of Defense Flight Information Publications (DOD FLIPs)

(5) Values established locally because of their significance to aircraft operations.

b. SKY CONDITION. A layer of clouds or obscuring phenomena aloft is present below:

(1) 1000 feet and no layer was reported below 1000 feet in the preceding "R", "S", or "RS" observation

(2) The highest instrument minimum (day or night, depending on the time of observation) exclusive of ILS, GCA or alternate minima, and no sky cover was previously reported below this minimum height.

c. VISIBILITY. Prevailing visibility decreases to less than, or if below, increases to equal or exceed:

(1) 3 miles

(2) 2 miles

(3) 1 1/2 miles

(4) 1 mile

(5) All nationally published minima, applicable to the airport, listed in the Coast and Geodetic Survey (C&GS) Instrument Approach Procedure Charts or Department of Defense Flight Information Publications (DOD FLIPs)

(6) Values established locally because of their significance to aircraft operations.

d. RUNWAY VISUAL RANGE.

(1) (WB,FAA) The highest value from the Designated RVR Runway during the preceding ten minutes rises above, if initially below, or drops below, if initially above the authorized minimum for operational use.

(2) (AF) The ten-minute mean RVR decreases to less than, or if below, increases to equal or exceed each nationally published minima applicable to the runway in use.

e. TORNADO, FUNNEL CLOUD OR WATERSPOUT.

(1) Is observed

(2) Disappears from sight

(3) Occurred within past six hours according to outside sources and was not observed or recorded at the station.

f. THUNDERSTORM.

(1) Begins (a special observation is not required to report the beginning of a new thunderstorm if one is currently reported as in progress at the station)

(2) Increases in intensity (T to T+)

(3) Ends (15 minutes after thunder is last heard).

g. PRECIPITATION.

(1) Hail begins or ends

(2) Freezing precipitation begins, ends or changes in intensity

(3) Ice pellets begin, end, or change intensity.

(4) (AF) Precipitation other than very light begins or ends.

h. WIND AND WIND SHIFTS.

(1) The average 1-minute wind speed suddenly increases to twice or more than twice the currently reported 1-minute wind speed and exceeds 26 knots

(2) Wind shifts.

i. (WB,FAA) PRESSURE JUMP. Required only at stations equipped with 12-hour microbarographs.

j. MISCELLANEOUS. Any other meteorological situation that in the opinion of the observer is critical to the safety of aircraft operations.

* 3.7.2.1 Single Element Specials. Single element specials are authorized to be taken (altimeter settings need not be appended) for:

a. Tornadic activity (para. A7-3.1)

b. Wind shifts (para. A10-3.6)

c. (AF,N) Runway conditions (para. A3-2.13.11).

* 3.7.3 Local Observations "L". Local observations may be taken and recorded at any weather observing station. Such observations may be taken for reasons other than those listed below. The content and criteria for these observations shall be determined locally. Local observations will be:

* a. Taken and recorded immediately following notification of an aircraft mishap occurring at or near the station unless there has been an intervening record or record special observation. Such observations will consist of all elements normally included in a record observation except sea-level pressure and will be identified in remarks as "ACFT MISHAP", plus any other desirable explanatory material. If the report is disseminated, the remark "ACFT MISHAP" is not included. An "ACFT MISHAP" local observation need not be recorded for in-flight emergencies; i.e., those declared to reflect an unsafe condition which could adversely affect the safety of the aircraft. However, such inflight emergencies should alert the observer to intensify the weather watch and to take and disseminate weather data as necessary to insure maximum

support to the aircraft in distress. If the inflight emergency results in an accident or incident, the "ACFT MISHAP" local observation is then required.

* b. (AF) Taken immediately following notification of a change in the runway in use. If the runway is dually instrumented, weather sensors will be changed before taking the observation. Include items 1, 2, 3, 7, 8, and 10 of table A2-1 in these observations. This observation is not required if the station has single instrumentation which is installed nearer the midpoint that the end-of-the-runway or if the station does not have ceiling, visibility, or wind equipment installed on any runway.

c. (AF) Taken at stations required to report RVV or one-minute mean RVR and:

(1) Criteria for taking RVR or RVV observations are first met, and when the criteria are first noted to no longer exist.

(2) RVR or RVV decreases to less than, or (if below) increases to equal or exceed, each RVV or RVR minima applicable to the runway in use.

(3) Rnn(d)VVNO or 1MRnn(d)VRNO is first required to be reported for the runway in use, and when it is first determined that the contraction is no longer applicable, provided conditions for reporting RVV or RVR exist.

d. (AF) Taken and disseminated for altimeter settings determined in accordance with paragraph A8-3.4.1.

3.7.3.1 (AF) Recording Local Observations. Local observations, except those taken in accordance with 3.7.3a, need not be recorded on MF1-10 when a printed record of the observation is made by a local dissemination device, e.g., Tel-Autograph, electrowriter, teletypewriter, etc.

3.7.4 Midnight Observations. These observations are taken to complete the climatological record of the day. Midnight observations may be omitted at those locations where 0000 LST coincides with the time of a six-hourly observation. The midnight observation consists of maximum and minimum temperatures and precipitation amounts. These data may be obtained at the time of the record observation and are recorded on the MF1-10 for the day ending at the time they are observed.

4. Instrumental Procedures.

4.1 Time Checks. Make time checks on all recording type instruments:

a. At the time of each six-hourly observation, and

b. When notified of an aircraft mishap.

4.2 Power and Equipment Failures. Indicate power and equipment failures on recording type instruments by entering on the recorder chart at the point of the failure, the term "POWER FAILURE" or "EQUIPMENT FAILURE" and the time, LST, of the failure. When the equipment is returned to service adjust the chart to the correct time if necessary, and enter a time check.

4.3 Time Adjustments. When a recorder is adjusted to the correct time, indicate the adjustment on the chart by entering an arrow at the point of the adjustment and writing the time, LST, of the adjustment near the arrow.

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CHAPTER A3. ENTRIES ON METEOROLOGICAL FORM 1-10

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CHAPTER A3

ENTRIES ON METEOROLOGICAL FORM 1-10

1. General.

1.1 Content. This chapter contains instructions for making entries on MF1-10 (formerly WBAN Form 10). Where reference is made to MF1-10A and MF1-10B, the reference is to columns 1 through 15 and 16 through 90 respectively.

1.1.1 Entries on MF1-10. Entries are made on MF1-10 in accordance with the following paragraphs.

1.1.2 Writing Instrument. Use a fine, black, ballpoint pen when available, otherwise use a black lead pencil of sufficient softness to insure legible copies and ample contrast for photographic reproduction, such as Grade 2 or 2H. When possible the same type instrument should be used throughout the form.

1.1.2.1 (AF, N) Use only black lead drawing pencils described above.

1.1.3 Separation of Data. Use slants, "/", in column 13 to separate data which, if not separated, might otherwise be subject to misinterpretation.

*1.1.4 Missing Data. Indicate missing data by entering an "M" in the appropriate space in all columns except 13. Enter a slant to denote missing elements in 3- and 6-hourly code groups. Explain briefly the reason for missing data in block 90, "Remarks, Notes and Miscellaneous Phenomena" of MF1-10.

*1.1.5 Parenthetical Data. Data entered on MF1-10 in columns 1-13 that are not to be transmitted over longline teletypewriter circuits are enclosed in parentheses.

*1.1.5.1 (WB, FAA) When temperatures entered in either columns 18, 47, 48, 66, or 67 were obtained from standby instruments which do not satisfy appropriate setting and exposured criteria, enclose the entry in parentheses.

1.1.6 Late Observations. When a record observation is taken late, and no appreciable changes have occurred since the standard time, enter the entire observation on MF1-10 in black and enter "DLAD" in column 13 in parentheses. When conditions have changed appreciably since the standard time, estimate the conditions probable at the observation time, using recording instruments whenever possible, and enter the observation on the form in red. Do not transmit these late observations entered in red.

1.2 Corrections. Errors on MF1-10 are corrected as follows:

1.2.1 Errors on MF1-10A.

1.2.1.1 Discovered Before Dissemination. Either erase the erroneous entries from all copies of the form and record corrected data in black, or draw a line through the erroneous entries and record corrections in black in the appropriate blocks on the same or next line.

* 1.2.1.2 Discovered After Either Local or Longline Dissemination. Draw a red line through the erroneous entry and record correction in red above it on copies. If insufficient space is available, enter the correction in red, appropriately identified, in column 13, e.g., SLPRES 969, etc. If the correction is transmitted over longline or local circuits, enter "COR" in red in column 13 followed by the time (GMT) the observer transmits the report or delivers it to communications personnel.

1.2.2 Errors on MF1-10B. Corrections are made in these columns by either erasing or drawing a line through the erroneous data and recording the correct data in black.

* 1.3 Heading. Enter heading information and other required data in the blocks provided on MF1-10.

Table A3-1. Sky Cover Symbols

Summation Amount of Sky Cover in Tenths	Symbol	Contraction When Symbols Not Used	Remarks
1/10 to less than 10/10 surface-based obscuring phenomena	-X	PTLY OBSCD	No height assigned this condition. Vertical visibility is not completely restricted.
10/10 surface-based obscuring phenomena	X	OBSCD	Always preceded by a "W" and a vertical visibility value.
Less than 1/10	○	CLR	This symbol is not used in combination with others. If considered significant include a remark in column 13 pertaining to the presence of less than 1/10 clouds, e.g., STFRA NW.
1/10 thru 5/10 half or more thin	- ①	THN SCTD	Height values preceding these symbols are never designated as ceiling layers.
1/10 thru 5/10 more than half opaque	①	SCTD	
6/10 thru 9/10 half or more thin	- ◍	THN BKN	
6/10 thru 9/10 more than half opaque	◍	BKN	Height value preceding this symbol prefixed with a ceiling layer designator provided a lower ceiling layer is not present.
10/10 half or more thin	- ⊕	THN OVC	Height value preceding this symbol is never prefixed with a ceiling layer designator.
10/10 more than half opaque	⊕	OVC	This symbol is used in combination with lower overcast layers only when such layers are classified as thin. Height value preceding this symbol is prefixed with a ceiling layer designator provided a lower broken ceiling layer is not present.

Only used to report layers aloft.

2. Entries on MF1-10 by Columns. In this section, the first decimal place of the paragraph number corresponds to the column number on the form.

2.1 Type of Observation (Column 1). Enter the designator for the type of report as follows:

DESIGNATOR	TYPE OF OBSERVATION
R	Record observation
S	Special observation
RS	Record Special observation
L	Local observation

*2.2 Time of Observation (Column 2). Enter the time (LST) that the last element of the observation was observed or evaluated.

2.3 Sky and Ceiling (Column 3). Enter sky cover data in accordance with the following paragraphs. Enter data for each layer of clouds and obscuring phenomena present at and below the highest layer visible from the observation site. Make entries in ascending order of the height of the bases of the layers. Use an additional line if more space is needed, and enter data in the following format:

2.3.1 Sky Cover Symbol. Enter sky cover visible from the observation site using the appropriate symbol or combination of symbols from table A3-1.

*2.3.2 Height of Sky Cover. Prefix each symbol, except clear and partly obscured conditions, with the height in hundreds of feet above the surface or field elevation using the increments shown in table A3-2.

Table A3-2. Sky Cover Height Values

Range of Height Values	Reportable Increment
5,000 or less	To nearest 100 ft.
5,001 to 10,000	To nearest 500 ft.
Above 10,000	To nearest 1,000 ft.

1. Encode height values that are halfway between reportable increments as the lower of the two increments.

2. Suffix the average of all observed values with a "V" (for "variable") whenever the ceiling height:

a. Is less than 3,000 feet, and

* b. Rapidly increases and decreases by one or more reportable values during the period of observation.

2.3.3 Ceiling Designator. Prefix a ceiling designator to the height of the first layer which is reported as either "X", "Φ", or "Φ", not classified as thin, using the appropriate designator from table A3-3.

Table A3-3. Sky Cover Ceiling Height Classification Designators

Ceiling Designator	Method Used to Determine Height
M	Measured (ceilometer, ceiling light, buildings, etc.)
R	Radar
A	Aircraft report
B	Balloon ascent (ceiling, pilot, raob)
E	Estimation
W	Vertical visibility into obscuration. This is the only symbol used with an X condition.

1. In general, when more than one current height evaluation is available, the designator and height reported should be based on the method of determination, using this table as a guide, on the recency of the observation and nearness of the observation site to the runway(s) in use. Designators are in general descending order of reliability.

2. Pilot reports of the maximum vertical height above the ground in surface-based obscuring phenomena (obscured sky) or the height of layers aloft, other than cirriform, need not be used if, in the judgment of the observer, they are not representative of conditions over the airport.

2.4 Prevailing Visibility (Column 4). Enter a value for the prevailing visibility at the usual point of observation using the reportable increments listed in table A3-4.

2.4.1 (WB, FAA) Tower Visibility (Column 4a). Whenever the visibility entered in column 4 is less than 4 miles, enter the prevailing visibility at the tower level using the reportable increments listed in table A3-4. Omit this entry if:

a. The entry in column 4 is twice or more than twice the visibility at the tower level or

b. The phenomenon obstructing the visibility at the usual point of observation does not reach the level at which the tower visibility is determined.

* 2.5 Weather and Obstructions to Vision (Column 5). Enter the weather and obstructions to vision occurring at the station at the time of the observation using the symbols from table A3-5. Indicate the intensity of weather when appropriate using the symbols for intensity from table A3-6.

Table A3-4. Reportable Visibility Values (miles)

Increments of Separation (Miles)							
1/16	1/8		1/4	1/2	1		5
0	3/8	1 1/4	2	2 1/2	3	10	15
1/16	1/2	1 3/8	2 1/4	3	4	11	20
1/8	5/8	1 1/2	2 1/2		5	12	25
3/16	3/4	1 5/8			6	13	30
1/4	7/8	1 3/4			7	14	35
5/16	1	1 7/8			8	15	40
3/8	1 1/8	2			9		etc.

1. Enter in statute miles at land stations, nautical miles on Navy ships and ocean-station vessels. When the visibility is halfway between consecutive tabular values, select the lower value.

* 2. When the prevailing visibility is more than 7 miles and is also estimated to be more than twice the distance to the most distant marker visible, code the visibility as twice the distance to that marker, rounded to the nearest reportable value, and add a "+" to the coded value, e.g., 12+, 8+, 20+, etc.

3. Suffix the average of all observed values with a "V" (for "variable") whenever the prevailing visibility:

(a) Is less than three miles, and

* (b) Rapidly increases and decreases by one or more tabular values during the period of the observation.

2.6 Sea-Level Pressure (Column 6). Enter the sea-level pressure in millibars using only the tens, units and tenths digits (without a decimal point), e.g., 1013.2 as 132.

2.6.1 Estimated Data. If the pressure is estimated, prefix the value with an "E".

2.6.2 (FAA) Omission of Entry. Designated FAA stations, e.g., LAWRS, are authorized to omit the recording and dissemination of sea-level pressure.

* 2.7 Temperature (Column 7). Enter the dry-bulb temperature to the nearest whole degree Fahrenheit. Prefix subzero temperatures with a minus sign.

2.11 Wind Character (Column 11). If gusts or squalls are observed in the 10 minutes prior to the observation, enter "G" for gust or "Q" for squall as appropriate followed by the peak speed in the 10-minute period.

2.12 Altimeter Setting (Column 12). Enter in inches of mercury using only the units, tenths and hundredths digits (without a decimal point). If the altimeter setting is below 29.00 inches, prefix the value with the word "LOW."

2.12.1 Estimated Altimeter Settings. Prefix altimeter settings with an "E" when these data are estimated (see A8-3.4).

2.13 Remarks (Column 13). Entries in this column are made to record operationally significant information not reported elsewhere; to elaborate on preceding coded data; or to record for dissemination supplementary 3- and 6-hourly synoptic data.

2.13.1 Order of Remarks. To facilitate the locating of desired remarks in the transmitted message, the following order should be followed as closely as possible:

a. Runway visual range or runway visibility
b. Surface-based obscuring phenomena
c. (WB, FAA) Surface or tower visibility
d. Wind shifts
e. Pilot and radar reports of bases and tops
f. Remarks elaborating on preceding coded data
g. 3- and 6-hourly additive data
h. Radiosonde data
i. (AF, N) Runway conditions
j. Weather modification
k. (WB, FAA) Notams.

* l. (WB,AF,N) Radiological Data (RIII Group)

2.13.1.1 General Coding Instructions. Some of the preceding requires the use of codes. Where plain language is called for, authorized contractions and weather symbols should be used to conserve communication time and space. However, in no case should an essential remark, of which the observer is aware, be omitted for the lack of readily available contractions or symbols. In such cases the only requirement is that the remark be clear. All time entries are in GMT with the time zone indicator omitted. Directions reported for the movement of clouds or other phenomena is the direction toward which the phenomena is moving. When using points of the compass to describe quardrants or sectors, enter in a clockwise order, e.g., "N-E"

2.13.2 Runway Visibility (RVV). Enter RVV when:

a. (WB, FAA, N) It is less than 2 miles along the appropriate runway, or the prevailing visibility is less than the highest instrument minimum for the appropriate runway.

* b. (AF) Prevailing and/or runway visibility is one mile or less and,

(1) RVR minimums have not been published for an instrumented runway in use, or

(2) When RVR is unavailable and visual RVV observations are required in accordance with A6-3.17.1.

* c. At RVR stations, RVV will not be reported unless the observer, at his discretion, uses it to indicate that the RVV is better than the RVR.

d. Do not substitute RVV for RVR when RVR is inoperative unless RVV is specifically requested by an appropriate traffic control authority.

e. Runway visibility is entered using the following format with meanings as shown:

(1) Rnn(d)VVvv or
(2) (WB,FAA,N) Rnn(d)VVvvVvv
(3) Rnn(d)VVNO
(4) Meanings:

R - Indicates that runway number follows
nn - Runway number
(d) - Runway number designator ("R" for right, "L" for left and "C" for center).
VV - Indicator that runway visibility data follows
vv - Runway visibility in miles and/or fraction of miles in reportable increments of the appropriate table:

(a) (WB,FAA,N) Use table A3-8A, B or C
* (b) (AF) Use table A3-9A, B, or C.
* (c) (AF) For reportable increments based on visual observations, (1) enter 1+ for RVV greater than 1 mile, and (2) use table A3-4 for RVV reportable values of 1 mile and below. When the lowest determinable RVV is 1/4, 3/16, or 1/8 mile, and RVV is observed to be less than this value, enter the value with a minus (i.e., 1/4-, 3/16-, 1/8-).

V - (WB,FAA,N) Indicates that runway visibility is variable by four or more reportable values in the past ten minutes. It is preceded by the lowest and followed by the highest limit of variability
NO - Indicates that data should be reported but is unavailable. Enter the contraction "NO" in place of "vv", e.g., R30LVVNO.

(a) (WB,FAA) Include the contraction "NO" on all observations until the outage has been reported in a NOTAM.

(5) (AF) Enclose RVV in parentheses to indicate that it is for local dissemination only.

Table A3-8A. (WB, FAA, N)

Runway Visibility From Transmissometer Conversion Table For 750-Foot Baseline

DAY			NIGHT		
Corrected Transmissometer Reading		Visibility	Corrected Transmissometer Reading		Visibility
From	To		From	To	
.013*	.072	1/8	.010§	.029	1/4
.073	.152	3/16	.030	.061	5/16
.153	.231	1/4	.062	.120	3/8
.232	.302	5/16	.121	.205	1/2
.303	.390	3/8	.206	.285	5/8
.391	.481	1/2	.286	.356	3/4
.482	.549	5/8	.357	.417	7/8
.550	.602	3/4	.418	.470	1
.603	.644	7/8	.471	.516	1 1/8
.645	.679	1	.517	.556	1 1/4
.680	.707	1 1/8	.557	.591	1 3/8
.708	.731	1 1/4	.592	.620	1 1/2
.732	.751	1 3/8	.621	.647	1 5/8
.752	.768	1 1/2	.648	.670	1 3/4
.769	.783	1 5/8	.671	.691	1 7/8
.784	.797	1 3/4	.692	.718	2
.798	.808	1 7/8	.719	.749	2 1/4
.809	.824	2	.750	.785	2 1/2
.825	.841	2 1/4	.786	.835	3
.842	.861	2 1/2	.836	.876	4
.862	.889	3	.877	.902	5
.890	.913	4	.903	.920	6
.914	.928	5	.921	.933	7
.929	.939	6	.934	.942	8
.940	.946	7	.943	.950	9
.947	.953	8	.951	.956	10
.954	.958	9			
.959	.961	10			

*If reading is less than .013, report visibility as "LESS THAN 1/8".

§If reading is less than .010, report visibility as "LESS THAN 1/4".

Computations based on the sighting of dark objects against horizon sky during daylight and light intensity of 25 cp. at night.

Table A3-8B. (WB, FAA, N)

Runway Visibility From Transmissometer Conversion Table For 500-Foot Baseline

DAY			NIGHT		
Corrected Transmissometer Reading		Visibility	Corrected Transmissometer Reading		Visibility
From	To		From	To	
.053*	.172	1/8	.010§	.044	3/16
.173	.285	3/16	.045	.096	1/4
.286	.376	1/4	.097	.155	5/16
.377	.450	5/16	.156	.243	3/8
.451	.534	3/8	.244	.348	1/2
.535	.614	1/2	.349	.433	5/8
.615	.670	5/8	.434	.502	3/4
.671	.713	3/4	.503	.559	7/8
.714	.746	7/8	.560	.605	1
.747	.772	1	.606	.643	1 1/8
.773	.793	1 1/8	.644	.676	1 1/4
.794	.811	1 1/4	.677	.704	1 3/8
.812	.826	1 3/8	.705	.727	1 1/2
.827	.839	1 1/2	.728	.748	1 5/8
.840	.850	1 5/8	.749	.766	1 3/4
.851	.859	1 3/4	.767	.782	1 7/8
.860	.868	1 7/8	.783	.802	2
.869	.879	2	.803	.825	2 1/4
.880	.891	2 1/4	.826	.851	2 1/2
.892	.905	2 1/2	.852	.887	3
.906	.925	3	.888	.915	4
.926	.941	4	.916	.934	5
.942	.951	5	.935	.945	6
.952	.959	6	.946	.955	7
.960	.964	7	.956	.961	8
.965	.968	8	.962	.966	9
.969	.972	9	.967	.972	10
.973	.974	10			

*If reading is less than .053, report visibility as "LESS THAN 1/8".

§If reading is less than .010, report visibility as "LESS THAN 3/16".

Computations based on the sighting of dark objects against horizon sky during daylight and the sighting of a 25 cp. light at night.

Table A3-8C. (WB, FAA, N)

Runway Visibility From Transmissometer Conversion Table For 250-Foot Baseline

DAY			NIGHT		
Corrected Transmissometer Reading		Visibility	Corrected Transmissometer Reading		Visibility
From	To		From	To	
.013*	.231	1/16	.018§	.101	1/8
.232	.415	1/8	.102	.210	3/16
.416	.534	3/16	.211	.309	1/4
.535	.614	1/4	.310	.394	5/16
.615	.671	5/16	.395	.493	3/8
.672	.731	3/8	.494	.590	1/2
.732	.783	1/2	.591	.658	5/8
.784	.819	5/8	.659	.709	3/4
.820	.845	3/4	.710	.747	7/8
.846	.864	7/8	.748	.778	1
.865	.879	1	.779	.802	1 1/8
.880	.891	1 1/8	.803	.822	1 1/4
.892	.901	1 1/4	.823	.839	1 3/8
.902	.909	1 3/8	.840	.853	1 1/2
.910	.916	1 1/2	.854	.865	1 5/8
.917	.922	1 5/8	.866	.875	1 3/4
.923	.927	1 3/4	.876	.884	1 7/8
.928	.932	1 7/8	.885	.896	2
.933	.937	2	.897	.908	2 1/4
.938	.944	2 1/4	.909	.922	2 1/2
.945	.951	2 1/2	.923	.942	3
.952	.962	3	.943	.957	4
.963	.970	4	.958	.966	5
.971	.975	5	.967	.972	6
.976	.979	6	.973	.977	7
.980	.982	7	.978	.980	8
.983	.984	8	.981	.983	9
.985	.986	9	.984	.985	10
.987	.987	10			

*If reading is less than .013, report visibility as "LESS THAN 1/16".

§If reading is less than .018, report visibility as "LESS THAN 1/8".

Computations based on the sighting of dark objects against horizon sky during daylight and the sighting of a 25 cp. light at night.

TABLE A3-9A (AF) TRANSMISSOMETER RUNWAY VISIBILITY CONVERSION TABLE (500-Foot Baseline)

Day Corrected Transmissivity Value (Percent)						RVV (Statute Miles)
LS 3		LS 4		LS 5		
From	To	From	To	From	To	
.000	.085	.000	.023	----	----	1/8-
.086	.184	.024	.069	----	----	1/8
----	----	----	----	.000	.026	3/16-
.185	.285	.070	.199	.027	.099	3/16
.286	.377	.200	.337	.100	.196	1/4
.378	.450	.338	.450	.197	.294	5/16
.451	.534	.451	.534	.295	.425	3/8
.535	.614	.535	.614	.426	.559	1/2
.615	.671	.615	.671	.560	.657	5/8
.672	.713	.672	.713	.658	.713	3/4
.714	.746	.714	.746	.714	.746	7/8
.747	.760	.747	.760	.747	.760	1
.761	1.000	.761	1.000	.761	1.000	1+

1. 1/8- and 3/16- are referred to in voice transmissions as "less than one-eighth mile" and "less than three-sixteenths mile" and 1+ as "greater than one mile."

2. 1+ is used to report runway visibilities in excess of one mile when prevailing visibility is one mile or less.

3. Subtract background illumination from the transmission reading before entering this table with the transmissivity value.

TABLE A3-9B (AF) TRANSMISSOMETER RUNWAY VISIBILITY CONVERSION TABLE (500-Foot Baseline)

Night Corrected Transmissivity Value (Percent)						RVV (Statute Miles)
LS 3		LS 4		LS 5		
From	To	From	To	From	To	
.000	.012	----	----	----	----	3/16-
.013	.027	----	----	----	----	3/16
----	----	.000	.024	.000	.013	1/4-
.028	.071	.025	.042	.014	.024	1/4
.072	.129	.043	.083	.025	.053	5/16
.130	.222	.084	.157	.054	.111	3/8
.223	.337	.158	.257	.112	.196	1/2
.338	.434	.258	.348	.197	.279	5/8
.435	.513	.349	.426	.280	.353	3/4
.514	.577	.427	.491	.354	.417	7/8
.578	.605	.492	.520	.418	.446	1
.606	1.000	.521	1.000	.447	1.000	1+

1. 3/16- and 1/4- are referred to in voice transmissions as "less than three-sixteenths mile" and "less than one-quarter mile" and 1+ as "greater than one mile."

2. 1+ is used to report runway visibilities in excess of one mile when prevailing visibility is one mile or less.

3. Subtract background illumination from the transmission reading before entering this table with the transmissivity value.

TABLE A3-9C (AF) TRANSMISSOMETER RUNWAY VISIBILITY CONVERSION TABLE
(500-Foot Baseline)

Day Corrected Transmissivity Value (Percent)		Runway Visibility (Statute Miles)	Night Corrected Transmissivity Value (Percent)	
From	To		From	To
.000	.052	1/8-	----	----
.053	.172	1/8	----	----
----	----	3/16-	.000	.010
.173	.285	3/16	.011	.044
.286	.376	1/4	.045	.096
.377	.450	5/16	.097	.155
.451	.534	3/8	.156	.243
.535	.614	1/2	.244	.348
.615	.670	5/8	.349	.433
.671	.713	3/4	.434	.502
.714	.746	7/8	.503	.559
.747	.760	1	.560	.605
.761	1.000	1+	.606	1.000

1. Computations are based on the sighting of dark objects against the horizon sky during daylight and the sighting of a 25 cp. light at night.
2. 1/8- and 3/16- are referred to in voice transmissions as "less than one-eighth mile" and "less than three-sixteenths mile" and 1+ as "greater than one mile."
3. 1+ is used to report runway visibilities in excess of one mile when prevailing visibility is one mile or less.
4. Use this table only when HIRL are not installed or are inoperative.
5. Subtract background illumination from the transmission reading before entering this table with the transmissivity value.

2.13.3 (WB, FAA, AF) Runway Visual Range. RVR is entered in column 13 whenever the reported prevailing visibility is one mile or less, or the highest RVR value for the designated RVR runway is 6000 feet or less.

a. The 10-minute values of RVR are based on the highest runway light setting available at the airport at Air Force stations, and on light setting 5 at civil stations. They are included in record and special observations for longline transmission. Use the following format with meanings as shown:

(1) (AF) Rnn(d)VRV$_F$V$_F$(V_S)
(2) (WB, FAA) Rnn(d)VRV$_n$V$_n$(V_S)VV$_X$V$_X$(V_S) or Rnn(d)VRV$_C$V$_C$ (V_S)
(3) Rnn(d) RNO
(4) Meanings:

R - Indicator that runway number follows
nn - Runway number
(d) - Runway number designator ("R" for right, "L" for left, and "C" for center)
VR - Indicator that visual range data follow
V$_F$V$_F$ - (AF) Mean value in hundreds of feet from RVR equation table A3-10
V$_n$V$_n$ - (WB, FAA) Lowest value in hundreds of feet of visual range for the past 10 minutes from appropriate RVR conversion table A3-11A, B, or C
V - (WB, FAA) Indicator separating lowest and highest values
V$_X$V$_X$ - (WB, FAA) Highest value in hundreds of feet of visual range for the past 10 minutes from appropriate RVR conversion table A3-11A, B, or C
V$_C$V$_C$ (WB, FAA) Constant value in hundreds of feet of visual range for the past 10 minutes. Encoded only when the recorder trace during the ten minutes preceding the observation has not varied by a reportable increment
V_S - Symbol "+" or "-" to indicate respectively that the preceding RVR value is either higher than the highest or lower than the lowest reportable value in the appropriate table.

(a) (WB, FAA) Table A3-11A, B or C
(b) (AF) Table A3-10

NO - Indicator that data normally available from the designated RVR runway are not available to the observer.

* (a) (WB,FAA) Include the contraction "NO" in all R, RS, and S observations until the outage has been reported in a NOTAM.

* (b) (AF) Ten-minute RVR is considered unavailable while awaiting readings due to runway in use changes and RVR computer outages.

(5) (WB, FAA) The 10-minute RVR extremes are encoded for the runway officially designated by the FAA for the reporting of RVR values in longline dissemination. This will normally be the runway having the lowest instrument minima.

* (6) (AF) Where RVR minimums have been established and equipment is not installed which is capable of computing ten-minute mean RVR values (e.g., at a joint use base without an FMN-1), AWS units will neither determine ten-minute RVR nor report Rnn(d)VRNO.

b. The 1-minute mean RVR is based on the current airport runway light setting and is normally obtained from digital readouts, entered using the following format with meanings as shown, and enclosed in parentheses to indicate that it is for local dissemination only.

(1) $1MRnn(d)VRV_rV_r(V_s)$

(2) (AF) 1MRnn(d)VRNO

(3) Meanings:

1M - Indicator for 1-minute mean RVR data
R - Indicator that runway number follows
nn - Runway number
(d) - Runway number designator ("R" for right, "L" for left and "C" for center)
VR - Indicator that visual range data follows
* V_rV_r - One-minute mean RVR is hundreds of feet using reportable values in table A3-10, A3-11A, B, or C as appropriate.
V_s - A symbol "," to indicate value greater than the highest reportable increment or "-" to indicate value below lowest reportable increment.
NO - (AF) Indicator that data normally available from the designated runway are not available. Follow this contraction with RVV data when required; e.g., "1MR30 VRNO/R30VV1/4".

(4) (WB,FAA) The 1-minute mean RVR is entered only when a direct readout of the RVR is not available to local users and a requirement for the data is established by local agreement between the WB, FAA, and local users. Additionally, the 1-minute RVR need not be entered if it is recorded elsewhere, e.g., on telewriters or voice tapes.

* 2.13.4 Surface-Based Obscuring Phenomena. Whenever the reported sky condition includes a partly obscured condition, that is "-X", indicate the

phenomena producing the obscuration, using the appropriate symbol, from table A3-15, and indicate the tenths of sky obscured following the symbol, e.g., "F6", "S8", "FK3", etc. No entry is required when amount of obscuration is zero or ten tenths. Enter direction of breaks or discontinuity in an obscuration that hides the sky overhead but does not hide all of the sky (hides more than 9/10 but not all of the sky), e.g., "THN F NW", "BRK IN F TO SE", etc.

Table A3-10. (AF) RVR Equation Table

Day			Night	
LS 3	LS 4	LS 5	LS 4	LS 3
10-	10-	10-	10-	10-
--	10	1[illegible]	10	--
--	--	14	12	10
10	12	16	14	12
12	14	18	16	14
14	--	20	18	--
16	16	22	--	16
18	18	24	20	18
20	20	26	22	--
22	22	28	24	20
24	24	28	--	--
26	26	30	26	22
28	28	32	28	24
30	30	34	30	--
32	32	34	--	--
34	34	36	--	26
36	36	38	32	28
38	38	38	--	--
40	40	40	34	--
--	--	40	36	30
45	45	45	38	32
--	--	45	40	--
50	50	50	--	34
--	--	50	--	36
55	55	55	45	38
--	--	55	--	40
60	60	60	50	--
60+	60+	60+	55	45
		60+	60	50
		60+	60+	55
		60+	60+	60
		60+	60+	60+

1. This table is used when the RVR computer is not being operated on the highest available light setting.

2. Enter the day or night column, as appropriate. Select the subcolumn headed with the current runway light setting and locate the indicated ten-minute mean RVR value. Move horizontally to the subcolumn containing values for the highest available runway light setting. Where a dash "-" appears, move up the column to where a value appears. This value is the reportable ten-minute mean RVR.

Table A3-11A.

RUNWAY VISUAL RANGE (RVR) - TRANSMISSION CONVERSION TABLE FOR 750-FOOT BASELINE

NIGHT				DAY			
RVR (ft.)	L.S. 5	L.S. 4	L.S. 3	RVR (ft.)	L.S. 5	L.S. 4	L.S. 3
1000-				1000-			*
1000	.00004	.00017	.00063	1000	.00769	.02941	.08919
1200	.00035	.00106	.00318	1200	.02450	.07342	.13841
1400	.00146	.00369	.00934	1400	.05257	.13304	.18762
1600	.00402	.00898	.02009	1600	.08984	.20088	.23452
1800	.00859	.01747	.03553	1800	.13321	.27096 *	.27815
2000	.01547	.02920	.05512	2000	.17982	.31825 *	.31825
2200	.02471	.04391	.07802	2200	.22743	.35492	.55492
2400	.03618	.06115	.10335	2400	.27450	.38837	.38837
2600	.04960	.08039	.13028	2600	.32002	.41890	.41890
2800	.06467	.10112	.15813	2800	.36342	.44679	.44679
3000	.08105	.12289	.18634	3000	.40437	.47232	.47232
3200	.09844	.14531	.21448	3200	.44275	.49573	.49573
3400	.11656	.16804	.24225	3400	.47857	.51727	.51727
3600	.13516	.19082	.26940	3600	.51190	.53713	.53713
3800	.15403	.21344	.29578	3800	.54286	.55548	.55548
4000	.17300	.23576	.32129	4000 *	.57160	.57248	.57248
4500	.20605	.27373	.36364	4500	.59939	.59939	.59939
5000	.25203	.32494	.41896	5000	.63257	.63257	.63257
5500	.29571	.37215	.46835	5500	.66077	.66077	.66077
6000	.33666	.41530	.51230	6000	.68501	.68501	.68501
6000+	.37472	.45455	.55139	6000+	.70606	.70606	.70606

*Values below this point based on contrast.

Table A3-11B.

RUNWAY VISUAL RANGE (RVR) - TRANSMISSION CONVERSION TABLE FOR 500-FOOT BASELINE

NIGHT				DAY			
RVR (ft.)	L.S. 5	L.S. 4	L.S. 3	RVR (ft.)	L.S. 5	L.S. 4	L.S. 3
1000-				1000-			*
1000	.00123	.00302	.00738	1000	.03897	.09528	.19962
1200	.00500	.01040	.02162	1200	.08436	.17533	.26757
1400	.01286	.02387	.04434	1400	.14033	.26061	.32774
1600	.02527	.04322	.07390	1600	.20059	.34300	.38030
1800	.04193	.06732	.10807	1800	.26083	.41874*	.42611
2000	.06208	.09482	.14483	2000	.31858	.46614*	.46614
2200	.08484	.12446	.18258	2200	.37259	.50129	.50129
2400	.10939	.15521	.22022	2400	.42237	.53231	.53231
2600	.13500	.18626	.25699	2600	.46787	.55985	.55985
2800	.16111	.21705	.29242	2800	.50926	.58443	.58443
3000	.18729	.24719	.32624	3000	.54683	.60649	.60649
3200	.21320	.27639	.35831	3200	.58091	.62637	.62637
3400	.23861	.30451	.38860	3400	.61183	.64439	.64439
3600	.26336	.33144	.41712	3600	.63992	.66077	.66077
3800	.28734	.35715	.44393	3800	.66547	.67574	.67574
4000	.31048	.38154	.46910	4000	.68875	.68946	.68946
4500	.34886	.42158	.50947	4500	.71090	.71090	.71090
5000	.39899	.47265	.55991	5000	.73690	.73690	.73690
5500	.44386	.51739	.60309	5500	.75864	.75864	.75864
6000	.48394	.55664	.64025	6000	.77708	.77708	.77708
6000+	.51976	.59118	.67241	6000+	.79292	.79292	.79292

*Values below this point based on contrast.

Table A3-11C.

RUNWAY VISUAL RANGE (RVR) - TRANSMISSION CONVERSION TABLE FOR 250-FOOT BASELINE

NIGHT				DAY			
RVR (ft.)	L.S. 5	L.S. 4	L.S. 3	RVR (ft.)	L.S. 5	L.S. 4	L.S. 3
600-				600-			
600	.00134	.00299	.00670	600	.02995	.06696	.14973
800	.01128	.02003	.03560	800	.10376	.18436	.32757*
1000	.03513	.05493	.08589	1000	.19740	.30867	.44679*
1200	.07074	.10198	.14702	1200	.29045	.41873	.51727
1400	.11338	.15451	.21056	1400	.37461	.51050	.57248
1600	.15897	.20788	.27184	1600	.44787	.58566	.61668
1800	.20477	.25946	.32874	1800	.51072	.64710*	.65277
2000	.24916	.30793	.38056	2000	.56443	.68274	.68274
2200	.29128	.35279	.42730	2200	.61040	.70802	.70802
2400	.33073	.39396	.46928	2400	.64990	.72960	.72960
2600	.36742	.43158	.50694	2600	.68401	.74823	.74823
2800	.40139	.46589	.54076	2800	.71362	.76448	.76448
3000	.43277	.49718	.57117	3000	.73948	.77877	.77877
3500	.48199	.54552	.61741	3500	.77742	.80003	.80003
4000	.54149	.60282	.67110	4000	.81945*	.82418	.82418
4500	.59064	.64929	.71377	4500	.84315	.84315	.84315
5000	.63166	.68749	.74827	5000	.85843	.85843	.85843
5500	.66623	.71929	.77659	5500	.87100	.87100	.87100
6000	.69566	.74608	.80016	6000	.88152	.88152	.88152
6000+	.72094	.76888	.82001	6000+	.89046	.89046	.89046

* Values below this point based on contrast.

2.13.5 (WB, FAA) Surface or Tower Visibility. When the prevailing visibility at the usual point of observation as entered in column 4 is less than 4 miles, and the tower visibility is not entered in column 4a, enter "TWR VSBY" followed by the prevailing visibility at the tower level using increments listed in table A3-4. This remark may be included in the report when the visibility at the usual point of observation is 4 miles or more if the observer believes that the remark is significant. If the tower visibility is entered in column 4a, and is different from the value entered in column 4, enter "SFC VSBY" followed by the value entered in column 4.

2.13.6. Wind Shifts. When wind shifts occur, enter WSHFT, followed by the time (GMT) the wind shift began. The contraction "FROPA" may be entered following the time if it is reasonably certain that the shift was the result of a frontal passage.

* 2.13.7 Pilot and Radar Reports of Bases and Tops. Enter available heights of bases not visible at the station and tops of sky cover layers within 20 nautical miles of the airport for noncirriform layers and within 50 nautical miles of the airport for cirriform layers. Omit data which is more than 15 minutes old unless it is considered to be operationally significant. In the event of multiple reports, use the one that is most complete and in reasonable agreement with other observed data. Enter the most recent data first, and separate each layer from other layers and each report from other remarks with slants. Make entries in the following order and format:

* a. Time in hours and minutes (GMT) preceding data more than 15 minutes old.

b. Distance and direction from station if reported.

c. Height of bases in hundreds of feet (MSL) if reported.

* d. Sky cover symbol for amount reported by pilot or amount of individual layer if reported by radar (i.e., do not use the summation principal). Enter "U" if amount or symbol is not reported or is unknown.

e. Height of tops in hundreds of feet (MSL), if reported.

EXAMPLES

/1730 15SW 50⊕/
/1105 ⊕ 165/

/⊕112/150⊕220/
/⊕65/0835 120⊕150/

/25U78/180U/

2.13.7.1 (AF) Radar Cloud Detection (RCD). Prefix the contraction, RCD, to reports obtained from radars, e.g., RCD ⊕ 120/220U280. If the report contains both RCD and pilot report data, also prefix the contraction "PIREP" to the portion pertaining to the pilot report.

*2.13.8 Remarks Pertaining to Preceding Coded Elements. Any information considered operationally significant or information needed to amplify preceding coded data should be included in remarks. Remarks on variability (ceiling, sky condition, visibility, intermittent precipitation, etc.), are not to be used as a means of circumventing the requirement for special or local observations. Some of the more common remarks which should be appended to weather observations, when occurring, are as follows:

OBSERVED	ENTRY IN COLUMN 13
a. CEILING AND SKY CONDITION	
(1) Breaks in overcast not classified as thin	"BINOVC" followed by direction from station, e.g., BINOVC NE
(2) Higher clouds visible thru breaks in overcast not classified as thin	HIR CLDS VSB
(3) Direction of breaks or an area absent of clouds with ceiling less than 1000 feet	"BRKS" followed by direction from station, e.g., "BRKS N" or "BRKS OVR MMKR"(Omit if breaks are in all quadrants)
(4) Obscuring phenomena aloft	Enter type, followed by height and corresponding sky-cover symbol, e.g., "K10Φ".
(5) Special cloud types:	
(a) Towering cumulus	"TCU" followed by direction from station, e.g., "TCU NW"
(b) Cumulonimbus and a thunderstorm is not being reported	"CB" followed by distance from station if known based on radar or pilot report, direction from station and movement if known, e.g., "CB 20S MOVG NE", "CB OVHD MOVG E".
(c) Cumulonimbus mamma	Same as (b) except use "CBMAM" in place of "CB"
(d) Altocumulus castellanus	"ACCAS" followed by direction from station
(e) Vertical or inclined trails of precipitation attached to clouds but not reaching the surface	"VIRGA" followed by direction from station

	(f) Standing lenticular clouds or rotor clouds	Enter description followed by direction from station, e.g., "FEW SML ACSL SW-WNW" or "APRNT ROTOR CLDS S","LRG ACSL S, CCSL OVR MTNS W"
*	(6) Variable sky condition during the period of observation (normally, the past 15 minutes)	Enter the condition existing at the actual time of observation, the letter "V", and the condition to which it varied during the period of observation; e.g., ΦVΦ. Include the height when necessary to distinguish between column 3 entries; e.g., 18ΦVΦ
	(7) Variable ceiling below 3000 feet	Enter range of variability separated by a "V", e.g., "CIG 15V20"
	(8) Differing ceiling or sky condition at distance from station	Enter description, e.g., "CIG LWR OVR CITY", "LWR CLDS W APCHG STN", "CLD BASE OBSCD BY MTNS W", etc.
	b. VISIBILITY	
	(1) Variable visibility reported when prevailing visibility is less than three miles	Enter "VSBY" followed by range of variability separated by a "V", e.g., "VSBY 1/4V3/4"
	(2) Differing sector visibility which is either less than 3 miles or is operationally significant	Enter "VSBY" followed by sector and sector visibility, e.g., "VSBY N2SE 1/2"
	(3) (AF, N) Prevailing visibility at levels other than the official point of observation when it is 4 miles or less and differs from the value in column 4	Enter location followed by the visibility value, e.g., "TWR VSBY 3"
*	c. WEATHER AND OBSTRUCTIONS TO VISION	(AF) When a special observation (for beginning and/or ending of tornadic activity, thunderstorm or hail) is not transmitted longline, enter the beginning and/or ending time in each subsequent S, R, or RS observation until it is transmitted longline.

(1) Tornado, Waterspout or Funnel Cloud	
(a) Observed while still in progress by station personnel	Enter time of beginning, direction from station, movement, e.g., "FUNNEL CLOUD B04 W MOVG NE"
(b) Observed by station personnel and has ended or disappeared	Enter time of ending, or beginning and ending, and direction of movement, e.g., "TORNADO E55 MOVD NE"
(c) Reported by public as having occurred in past 6 hours and has not been observed at the station or previously reported by another source	Enter source, or if unknown enter "UNCONFIRMED", location, direction of movement, and time it was observed in hours and minutes, e.g., "UNCONFIRMED TORNADO 15W STJ MOVG N 1608"
(2) Thunderstorms	Enter the time thunderstorm activity began in minutes past the hour. Also enter the direction from station, and if known, the direction of movement for each center of activity.
* (a) In progress at station	
(b) Has ended or disappeared	Enter times of beginning and/or ending and direction of movement, e.g., "TB30E48 MOVD E"
(3) Lightning	Enter frequency, type, direction from station, e.g., "OCNL LTGCCCG N" Direction may be omitted if the same as that of the thunderstorm remark, e.g., "FQT LTGICCA"
(4) Precipitation	
(a) Hail	Enter time of beginning and/or ending, and diameter in inches of the largest hail stones, e.g., "AB35E55 HLSTO 2"
(b) Intermittent precipitation occurring at observation time or within past 15 minutes	Enter type and intensity as appropriate, e.g., "INTMT R-"
(c) Showers have occurred within past 15 minutes but not occurring at observation time	Enter frequency of showers, type and intensity, e.g., "OCNL RW-"

(d)	Wet snow (snow that contains a great deal of liquid)	Enter "WET SNW"
(e)	Snow depth has increased by one inch or more in the past hour	Enter "SNOINCR" followed by the increase in snow depth in inches, e.g., "SNOINCR 2"
(f)	Variation of intensity	Enter type and range of variability separated by the frequency of variation, e.g., "R- OCNLY R"
(g)	Precipitation at a distance but not at station	Enter form, intensity (report "U" for unknown intensity) and direction from station or location, e.g., "RWU OVR RDGS N"
(h)	(WB, FAA, N) Precipitation begins, ends or changes form	Enter (in record observation only) the type and times of beginning and/or ending. E.g., "RB20E30SB30". Report times for separate periods only if the intervening period of no precipitation exceeds 15 minutes.
(i)	(WB) Precipitation exceeds 1/2 in. (water equivalent) during a one-hour period	Enter "PCPN" followed by the amount in past hour to hundredths of an inch, e.g., "PCPN 103" for 1.03 inches of precipitation (first-order stations only)

(5) Obstructions to Vision:

(a)	Fog dissipating or increasing	Enter "F DSIPTG" or "F INCRG"
(b)	Smoke drifting over field	"K DRFTG OVR FLD"
(c)	Shallow ground fog (height less than 6 feet)	"SHLW GF" followed by "DEP" and depth in feet if known, e.g., "SHLW GFDEP4
(d)	Drifting snow (height less than 6 feet) and blowing snow is not reported	"DRFTG SNW"

(e) Dust devils	"DUST DEVILS" followed by direction from station
(f) Obscuring phenomena at a distance from and not at the station	Enter type, description and direction from the station, e.g., "F BANK N-E-S"

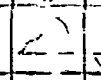
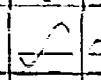
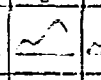
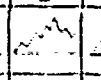
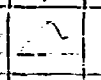
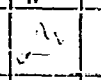
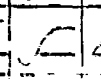
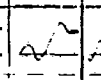
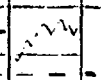
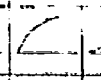
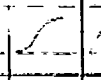
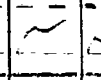
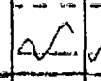
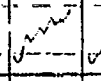
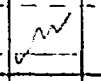
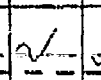
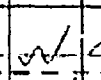
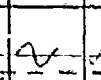
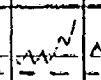
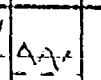
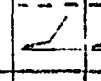
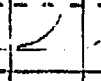
d. PRESSURE

(1) Barogram V	Enter (in record observations only) "LOWEST PRES" followed by the lowest sea-level pressure in tens, units and tenths of millibars and time (GMT) of occurrence, e.g., LOWEST PRES 631 2345
(2) Rising or falling at a rate of 0.06 inch or more per hour	"PRESRR" or "PRESFR"
(3) Pressure unsteady as shown on the barogram by sharp troughs and crests that depart from the mean trend by at least 0.03 inch	"PRES UNSTDY"
(4) Pressure jump (at stations using a 12-hour microbarograph) as indicated by a pressure rise at a rate exceeding 0.005 inch per minute and:	Enter "PRJMP" followed by the magnitude of the jump to the nearest 0.01 inch (omit decimal and zeros preceding the first significant digit), the time in hours and minutes (GMT) when it began and the time in minutes when the jump ended, e.g., a jump of 0.08 inch which began at 1012 and ended at 1018 is reported as "PRJMP 8/1012/18"
(a) the rise is at least 0.02 inch	
(b) the pressure remains at least 0.02 inch higher than at beginning of jump for 20 minutes	
(c) The beginning of the jump is distinctly separated from the beginning of any preceding jump by	

		at least 20 minutes, and by a segment of the trace having a rise less than 0.01 inch per 2 minutes, or steady or falling.	
	e.	WIND	
*		(1) Peak wind speed observed or recorded in the past hour.	Enter "PK WND", the direction and speed, separated by a slant, and the time of occurrence in minutes past the hour; e.g., PK WND 27/43 23. Make this entry: a. In each record observation while hail, thunderstorm or tornadic activity is in progress, and b. In the first record observation following the ending or disappearance of hail, thunderstorm or tornadic activity, and c. In the first record observation following any occurrence of peak speed of 35 knots or more when this speed is not reported under a or b above.
*		(2) Variable wind direction (should be reported when the direction is variable and the speed is greater than six knots)	Enter "WND" followed by range of variability; e.g., WND 270V310.
		(3) (AF) Magnetic wind direction. Used at locations that disseminate observation in accordance with A4-4.1.1 (AF)	Enter in tens of degrees using symbolic form MAGdd, e.g., MAG16 indicates magnetic direction of 160 degrees.

2.13.9 Three- and Six-Hourly Scheduled Coded Groups. Table A2-2 indicates the groups sent by the various types of stations. Stations that transmit

Table A3-12. Determination of Characteristics of Barometer Tendency

DESCRIPTION OF CHARACTERISTIC		NOMINAL GRAPHIC REPRESENTATION (For Coding Purposes)								Code Figure
PRIMARY UNQUALIFIED REQUIREMENT	ADDITIONAL REQUIREMENTS	A	B	C	D	E	F	G	H	
HIGHER Atmospheric pressure now higher than 3 hours ago.	Increasing, then decreasing.									0
	Increasing, then steady, or									1
	Increasing, then increasing more slowly.									
	Increasing: Steadily									2
	Increasing: Unsteadily									
	Decreasing or steady, then increasing, or									3
	increasing, then increasing more rapidly.									
THE SAME Atmospheric pressure now same as 3 hours ago.	Increasing, then decreasing.									0
	Steady									4
	Decreasing, then increasing.									5
LOWER Atmospheric pressure now lower than 3 hours ago.	Decreasing, then increasing.									5
	Decreasing, then steady; or									6
	decreasing, then decreasing more slowly.									
	Decreasing: Steadily									7
	Decreasing: Unsteadily									
	Steady or increasing, then decreasing, or									8
	decreasing, then decreasing more rapidly									

TABLES

Table A7-1. Intensity of Precipitation (other than drizzle) on Rate-of-Fall Basis	
Very light	Scattered drops or flakes that do not completely wet or cover an exposed surface, regardless of duration.
Light	Trace to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.
Moderate	0.11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.
Heavy	More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

Table A7-2. Intensity of Drizzle on Rate-of-Fall Basis	
Very light	Scattered drops that do not completely wet an exposed surface, regardless of duration.
Light	Trace to 0.01 inch per hour.
Moderate	More than 0.01 inch to 0.02 inch per hour.
Heavy	More than 0.02 inch per hour.

*

Table A7-3. Intensity of Drizzle or Snow with Visibility as Criteria	
Very light	Scattered flakes or droplets that do not completely cover or wet an exposed surface, regardless of duration.
Light	Visibility 5/8 statute mile or more.
Moderate	Visibility less than 5/8 statute mile but not less than 5/16 statute mile.
Heavy	Visibility less than 5/16 statute mile.

Table A7-4. Estimating the Intensity of Ice Pellets	
Very light	Scattered pellets with no accumulation.
Light	Few pellets falling with no appreciable accumulation.
Moderate	Slow accumulation.
Heavy	Rapid accumulation.

Table A7-5. Estimating the Intensity of Rain	
Very light	Scattered drops that do not completely wet an exposed surface, regardless of duration.
Light	Individual drops are easily seen; slight spray is observed over pavements; puddles form slowly; over two minutes may be required to wet pavements completely; sound on roofs ranges from slow pattering to gentle swishing; steady small streams may flow in gutters and downspouts.
Moderate	Individual drops are not clearly identifiable; spray is observable just above pavements and other hard surfaces, puddles form rapidly; downspouts on buildings seen 1/4 to 1/2 full; sound on roofs ranges from swishing to gentle roar.
Heavy	Rain seemingly falls in sheets; individual drops are not identifiable; heavy spray to height of several inches is observed over hard surfaces; downspouts run more than 1/2 full; visibility is greatly reduced; sound on roofs resembles roll of drums or distant roar.

3. Observing and Reporting Procedures.

* 3.1 Tornado, Waterspout and Funnel Cloud. Report these phenomena when they are observed by station personnel to begin, and/or disappear. The report need not include any element unrelated to the phenomena. A report should also be filed if a tornado, waterspout or funnel cloud is reported by the public within 6 hours of its occurrence and was not observed by station personnel. Insofar as is known, the report should contain the following:

a. Source of report if other than station personnel

b. Type of phenomenon (spelled out)

c. Time of beginning, ending or disappearance, or both to the nearest minute

d. Location with respect to station or with reference to a nationally known point (show distance in nautical miles)

e. Direction toward which the phenomenon is moving. If this element is unknown, enter "MOVMT UNKN"

f. (WB, FAA, N) Except at SAWR and A-type stations, the above elements should also appear in the remarks of the next transmitted record observation if the initial report is not a record special observation.

3.2 Thunderstorm.

3.2.1 Beginning of a Thunderstorm. A thunderstorm is considered to begin at a station when:

a. Thunder is heard, or

b. Overhead lightning or hail is observed and the local noise level is such as might prevent hearing thunder.

3.2.2 Ending of a Thunderstorm. A thunderstorm is considered to have ended 15 minutes after thunder is last heard.

3.2.3 Intensity of Thunderstorms. The intensity of a thunderstorm is based on the following characteristics, observed within the previous 15 minutes:

a. Thunderstorm (T), wind gust less than 50 knots and hail, if any, less than 3/4 inch in diameter.

b. Severe Thunderstorm (T+), wind gusts of 50 knots or greater or, hail 3/4 inch or greater in diameter.

* 3.2.4 Reporting a Thunderstorm. Reports concerning thunderstorms should be made whenever a thunderstorm begins, ends, and increases in intensity. The report should include the following as remarks:

a. Type (T or T+)

b. Time of beginning, ending, or both, to the nearest minute

c. Location and distance of each storm center with respect to the station if known.

d. Direction toward which the storm is moving. Omit if unknown.

e. Type of lightning.

f. (WB, FAA, N) The above remarks should also be included in the remarks of the next transmitted record observation if the initial report is not a record special observation.

* 3.3 Hail. A special observation should be taken when hail is observed to begin or end. The report should include the following in remarks:

a. Time of beginning, ending, or both to the nearest minute

b. Size of hailstones

c. (WB, FAA, N) Except at SAWR and A-type stations repeat the times of beginning and/or ending in the next transmitted record observation if the initial report is not a record special observation.

3.3.1 Intensity of Hail. All occurrences of hail are reported as moderate in aviation observations.

3.4 Freezing Precipitation. A special observation should be taken whenever freezing precipitation begins, ends, or changes intensity.

3.4.1 (WB, FAA, N) Time of Beginning and/or Ending. Except at SAWR and A-type stations include the time freezing precipitation began and/or ended in the remarks of the first record or record special observation after the event is first observed.

3.4.2 Intensity of Freezing Precipitation.

3.4.2.1 Freezing Drizzle. When freezing drizzle is occurring alone, determine the intensity by use of Table A7-3, Visibility as Criteria. Use Table A7-2, Rate-of-Fall as Criteria, if drizzle is occurring with other phenomena.

CONTENTS

CHAPTER A8. PRESSURE

TABLES

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CHAPTER A8

PRESSURE

1. General.

1.1 Content. The instructions in this chapter will be used for routine pressure determinations. The latest edition of Federal Meteorological Handbook (FMH) #8 - Barometry will be used as a general reference on the subject. Until it is revised or reprinted the references in this chapter to "FMH #8 - Barometry" will actually refer to the Manual of Barometry (WBAN), First Edition (1963). In this chapter, section 1 contains general information; section 2, definitions; section 3, observing and reporting procedures. Refer to chapter A3 for recording pressure information on Meteorological Form (MF) 1-10 and to chapter A12 for equipment operating and calibration instructions.

2. Definitions.

2.1 Altimeter Setting (QNH). That pressure value to which an aircraft altimeter scale is set so that it will indicate the altitude above MSL of an aircraft on the ground at the location for which the value was determined.

2.2 Atmospheric Pressure. The pressure exerted by the atmosphere at a given point.

2.3 Barogram V (also termed "Pressure V"). A fall in pressure at the rate of 0.06 inch or more per hour, followed by an abrupt rise in pressure at the rate of 0.06 inch or more per hour, with rise and fall each equaling 0.03 inch or more.

2.4 Barometric Pressure. The atmospheric pressure measured by a barometer.

2.5 Field Elevation, H_a. The officially designated field elevation (H_a) of an airport above mean sea level. It is the elevation of the highest point on any of the runways of the airport.

2.6 Pressure Altitude. The altitude, in the standard atmosphere, at which a given pressure will be observed. It is the indicated altitude of a pressure altimeter at an altimeter setting of 29.92 inches of mercury and is therefore the indicated altitude above the 29.92 constant-pressure surface.

2.7 Pressure Change. The net difference between the barometric pressure at the beginning and ending of a specified interval of time, usually the 3-hour period preceding an observation.

2.8 Pressure Characteristic. The pattern of the pressure change, as indicated by the barograph trace, during a specified interval of time, usually the 3-hour period preceding an observation.

2.9 Pressure Falling Rapidly. A fall in station pressure at the rate of 0.06 inch or more per hour, which totals 0.02 inch or more.

2.10 Pressure Jump. Generally, a rise in pressure exceeding 0.005 inch per minute which totals 0.02 inches or more.

2.11 Pressure Rising Rapidly. A rise in station pressure at the rate of 0.06 inch or more per hour, which totals 0.02 inch or more.

2.12 Pressure Tendency. The pressure characteristic and amount of pressure change during a specified period of time, usually the 3-hour period preceding an observation.

2.13 Pressure Unsteady. Sharp troughs and crests in the pressure trace which depart at least 0.03 inch from the mean trend.

2.14 Sea-Level Pressure. A pressure value obtained by the theoretical reduction of station pressure to sea level. Where the earth's surface is above sea level it is assumed that the atmosphere extends to sea level below the station and that the properties of the hypothetical atmosphere are related to conditions observed at the station.

2.15 Standard Atmosphere. A hypothetical vertical distribution of the atmospheric temperature, pressure, and density; which by international agreement is considered to be representative of the atmosphere for pressure-altimeter calibrations, and other purposes.

2.16 Station Elevation, H_p. The officially designated station elevation, H_p, is the height above sea level to which station pressure and altimeter settings pertain. It is generally 10 feet higher than the field elevation (i.e., $H_a + 10'$).

2.17 Station Pressure. The atmospheric pressure at the assigned station elevation.

* 2.18 Density Altitude. The pressure altitude corrected for temperature deviations from the standard atmosphere.

e. A single precision aneroid barometer, altimeter setting indicator or aircraft-type altimeter that is not routinely compared with a mercury barometer. These values are regarded as estimated.

3.4.1 Frequency of Determination. Determine the altimeter setting for all observations (see table A2-1). Redetermine the altimeter setting

a. When necessary to meet local requirements, which shall be determined locally thru coordination with using agencies.

b. Upon request.

c. (AF) At a frequency not to exceed 35 minutes since the last determination.

* d. (AF) An exception to the requirement of 3.4.1c is granted at locations where there is limited air traffic, no air traffic control personnel on duty, etc., provided:

(1) The base commander and local agencies concerned agree in writing (the agreement will be reconfirmed annually and when signatories are reassigned),

(2) Firm procedures are established to insure that the observer is notified at least 30 minutes prior to each aircraft arrival and departure, and

(3) The altimeter setting is redetermined within 30 minutes prior to all aircraft arrivals and departures.

3.4.2 Method of Determination. Altimeter setting values are determined by one of the following methods:

a. Read directly from a properly calibrated altimeter setting indicator if one is available.

b. Obtained or derived from the highest priority pressure-measuring instrument available (see table A8-1) at stations not equipped with an altimeter setting indicator. At these stations compute the altimeter setting value by using a computer, constant or table.

3.4.3 (WB, FAA) Altimeter-Setting Indicator.

a. Tap the face of the instrument lightly with the finger to reduce the effect of friction.

b. Read the pressure scale of the indicator at the pointer, to the nearest 0.005 inch.

c. Algebraically add this reading and the posted correction.

d. Use the sum of the reading and correction, rounded to the nearest 0.005 inch, when computing the station pressure or pressure altitude from the altimeter setting. Round to inches and hundredths when recording and reporting the altimeter setting.

3.4.3.1 (WB) Aircraft-Type Altimeters. At SAWR stations equipped with an aircraft-type altimeter which is not compared routinely with a calibrated mercury barometer at the same location, altimeter setting values may be determined using the procedures of ¶4.3 of this chapter.

3.4.4 Pressure Reduction Computer, WBAN 54-7-8. Compute the altimeter setting in inches and hundredths using the station pressure to the nearest 0.005 inch and the instructions on the white side (No. II) of the computer.

3.4.5 Reduction Constant. At low-level stations for which an altimeter-setting reduction constant has been authorized, algebraically add the constant to the station pressure and round to inches and hundredths to obtain the altimeter setting. Authorized constants are given in separate instructions, e.g., ¶8.1.3.4 FMH #8, Barometry.

3.4.6 Altimeter Setting Table. At authorized stations (see ¶3.2.4c(1)), find in the body of the table the altimeter setting in inches and hundredths, corresponding to the station pressure to the nearest 0.005 inch, as illustrated below:

EXAMPLES

A portion of an altimeter setting table for station elevation (H_p) = 1425 feet follows:

Station Pressure (inches)	.00	.01	.02	.03	.04
27.60------	29.06	29.07	29.08	29.10	29.11
27.70------	29.17	29.18	29.19	29.20	29.21

a. Given: Station Pressure 27.730"

Value from table found on line for 27.270 and in column headed .03---------- 29.20"

b. Given: Station Pressure 27.625"

Value from table found on line for 27.60 and interpolating between columns headed .02 and .03----------29.09"

c. Given: Station Pressure 27.615"

Value from table found on line
for 27.60 and interpolating
between columns headed
.01 and .02----------29.075"

Above value rounded to nearest .01 inch---29.08"

3.4.7 (WB) Aircraft-Type Altimeters for Operational Purposes. Altimeter setting values may be obtained from one or more aircraft-type altimeters at SAWR stations not equipped with a precision aneroid barometer or altimeter setting indicator. Aircraft-type altimeters should be installed, calibrated, adjusted and read in accordance with applicable instructions; such as those issued by the FAA and those in ¶4.3 of this chapter and in A12-5.2.6.

3.4.8 Estimated Values. Prefix the letter "E" to altimeter settings based upon an aneroid instrument which has not been compared routinely in accordance with ¶3.4. Aneroid performance must conform to the standards given in A12-5.2 in order to yield altimeter setting values that are reliable, i.e., not estimated.

3.4.9 Q Signals. In international aviation practice the "Q signals" QNH, QNE, and QFE are employed to designate different types of pressure settings for aircraft altimeters:

a. QNH. The term QNH is used to designate the altimeter setting as defined in ¶2.1. A pressure altimeter with a current local QNH setting should indicate altitude MSL, i.e., above mean sea level. The QNH setting is used in the United States, for purposes of landing, terrain clearance, and vertical separation of aircraft operating at altitudes below 18,000 feet MSL.

b. QNE. The term QNE is used to designate the standard altimeter setting value of 29.92 inches. A pressure altimeter with a QNE setting indicates the Pressure Altitude (see ¶2.6). The QNE setting is used, in the United States, for setting altimeters in aircraft operating at or above an altitude of 18,000 feet MSL.

c. QFE. The term QFE is used to designate a setting based upon the station pressure. A pressure altimeter with a current local QFE setting will indicate zero altitude when the aircraft is on the ground at the location for which the setting was determined. The station pressure, in millibars is sometimes requested by aviation interests for use as the QFE setting. See FMH #8, Barometry, and DOD Flight Information Publication, Planning.

3.5 Pressure Altitude. Compute pressure altitude as frequently as necessary to meet local needs, which are primarily for jet-plane operations. Use

the station pressure or the altimeter setting to the nearest 0.005 inch in the computations. The military services and other agencies interested in aviation require the pressure altitude with reference to the 10-foot plane above the field elevation (H_a + 10'). In view of this requirement, select one of the methods given below which is most convenient, considering availability of station pressure and altimeter setting data, and whether or not station elevation (H_p) is equal to H_a + 10'.

3.5.1 Local Pressure Altitude Tables. Special local pressure altitude tables may be prepared for specific locations in accordance with separate instructions, e.g., FMH #8, Barometry. Such tables, including temperature corrections, are required for accurate results at locations where the station elevation differs from H_a + 10' by about 40 feet or more, depending on local variations of temperature from standard atmosphere conditions.

3.5.2 Altimeter Setting and Pressure Reduction Computer. The altimeter setting may be converted to the pressure altitude (H_a + 10') with the Pressure Reduction Computer (No. II) white side as follows:

a. Set the field elevation on the "H" scale opposite the altimeter setting on the "P, A.S." scale.

b. Read the pressure altitude on the "H" scale opposite the 29.92 inch graduation index of the "P, A.S." scale.

c. Since the computer has two overlapping "H" scales the following criteria should be used in selecting the proper pressure altitude value from these scales:

(1) If the altimeter setting reads lower than 29.92", the pressure altitude will be higher than the elevation of the field.

(2) If the altimeter setting reads higher than 29.92", the pressure altitude will be lower than the field elevation.

(3) The pressure altitude will differ from the field elevation by about 900 to 1,000 feet for each inch of difference between the altimeter setting and 29.92".

EXAMPLE

Given: Field elevation 2963 feet, and altimeter setting 30.045 inches.

Find the field elevation value of 2963 on the "H" scale and set opposite the altimeter setting value of 30.045" on the "P, A.S." scale. Pressure altitude read on the "H" scale opposite the 29.92" graduation of the "P, A.S." scale is 2848 feet.

3.5.3 Altimeter Setting and Pressure Altitude Table. Table A8-2 or other standard atmosphere table may be used to obtain the pressure altitude.

Computations based upon the altimeter setting yield pressure altitude with reference to the 10-foot plane above the field elevation (H_a + 10'). Find in the body of the table the value corresponding to the altimeter setting and add the field elevation to this value to obtain the pressure altitude.

EXAMPLE

A portion of a Standard Atmosphere Table giving tabular values of pressure altitude follows:

Pressure (inches)	.00	.01	.02	.03	.04	.05	.06
	ft.	ft.	ft.	ft.	ft.	ft.	ft.
26.90	2916	2906	2896	2886	2876	2866	2855
30.00	-73	-82	-91	-100	-110	-119	-128

Given: Field elevation 2963 feet, and altimeter setting 30.045 inches

Using table and altimeter setting:
Value from table found on line for 30.00 inches and interpolating between columns headed .04 and .05 is -115; add the field elevation and obtain 2848 feet (i.e., -115 + 2963 = 2848).

3.5.4 Station Pressure and Pressure Reduction Computer. The station pressure may be converted to the pressure altitude at the station elevation (usually the 10-foot plane above the field elevation) by using instructions and scales on the white (No. II) side of the Pressure Reduction Computer.

EXAMPLE

Given: Station Pressure 26.965 inches

Using Computer: Set the zero elevation graduation of the "H" scale opposite 26.965" on the "P, A.S." scale. Pressure altitude read on the "H" scale opposite the 29.92" graduation of the "P, A.S." scale is 2850 feet.

3.5.5 Station Pressure and Pressure Altitude Table. Computations made by direct conversion of station pressure yield pressure altitude with reference to the station elevation H_p, which is not always the same as the 10-foot plane above the field elevation, H_a + 10'.

EXAMPLE

Given: Station Pressure 26.965 inches and table A8-2 or the foregoing excerpt from that table:

Value from table found on line for 26.90" and interpolating between columns headed .06 and .07 is 2850 feet.

Table A8-2. Pressure Altitude

Standard Atmosphere Table in Accordance With Specifications of ICAO (International Civil Aviation Organization)

Tabular values give altitude (in feet) in the standard atmosphere as a function of pressure (inches of mercury, shown as side and top argument).

Note: Altitudes are stated in terms of "standard geopotential feet."

Pressure, inches of mercury	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
20.0	10731	10718	10705	10692	10680	10667	10654	10641	10629	10616
20.1	10603	10590	10577	10565	10552	10539	10526	10514	10501	10488
20.2	10476	10464	10450	10437	10425	10412	10399	10387	10374	10361
20.3	10349	10336	10323	10311	10298	10285	10273	10260	10248	10235
20.4	10222	10210	10197	10185	10172	10159	10147	10134	10122	10109
20.5	10096	10084	10071	10059	10046	10034	10021	10009	9996	9984
20.6	9971	9959	9946	9934	9921	9909	9896	9884	9871	9859
20.7	9846	9834	9821	9809	9796	9784	9772	9759	9747	9734
20.8	9722	9709	9697	9685	9672	9660	9647	9635	9623	9610
20.9	9598	9586	9573	9561	9549	9536	9524	9512	9499	9487
21.0	9475	9462	9450	9438	9425	9413	9401	9388	9376	9364
21.1	9352	9339	9327	9315	9303	9290	9278	9266	9254	9241
21.2	9229	9217	9205	9192	9180	9168	9156	9144	9131	9119
21.3	9107	9095	9083	9071	9058	9046	9034	9022	9010	8998
21.4	8986	8973	8961	8949	8937	8925	8913	8901	8889	8877
21.5	8864	8852	8840	8828	8816	8804	8792	8780	8768	8756
21.6	8744	8732	8720	8708	8696	8684	8672	8660	8648	8636
21.7	8624	8612	8600	8588	8576	8564	8552	8540	8528	8516
21.8	8504	8492	8480	8468	8456	8444	8432	8420	8408	8397
21.9	8385	8373	8361	8349	8337	8325	8313	8301	8289	8278
22.0	8266	8254	8242	8230	8218	8206	8195	8183	8171	8159
22.1	8147	8136	8124	8112	8100	8088	8076	8065	8053	8041
22.2	8029	8018	8006	7994	7982	7971	7959	7947	7935	7924
22.3	7912	7900	7888	7877	7865	7853	7841	7830	7818	7806
22.4	7795	7783	7771	7760	7748	7736	7725	7713	7701	7690
22.5	7678	7666	7655	7643	7631	7620	7608	7597	7585	7573
22.6	7562	7550	7538	7527	7515	7504	7492	7481	7469	7457
22.7	7446	7434	7423	7411	7400	7388	7376	7365	7353	7342
22.8	7330	7319	7307	7296	7284	7273	7261	7250	7238	7227
22.9	7215	7204	7192	7181	7169	7158	7146	7135	7124	7112
23.0	7101	7089	7078	7066	7055	7043	7032	7021	7009	6998
23.1	6986	6975	6964	6952	6941	6929	6918	6907	6895	6884
23.2	6873	6861	6850	6839	6827	6816	6804	6793	6782	6770
23.3	6759	6748	6736	6725	6714	6703	6691	6680	6669	6657
23.4	6646	6635	6624	6612	6601	6590	6578	6567	6556	6545
23.5	6533	6522	6511	6500	6488	6477	6466	6455	6444	6432
23.6	6421	6410	6399	6388	6376	6365	6354	6343	6332	6320
23.7	6309	6298	6287	6276	6265	6253	6242	6231	6220	6209
23.8	6198	6187	6176	6164	6153	6142	6131	6120	6109	6098
23.9	6087	6076	6064	6053	6042	6031	6020	6009	5998	5987
24.0	5976	5965	5954	5943	5932	5921	5910	5899	5888	5877
24.1	5866	5854	5843	5832	5821	5810	5799	5788	5777	5766
24.2	5756	5745	5734	5723	5712	5701	5690	5679	5668	5657
24.3	5646	5635	5624	5613	5602	5591	5580	5569	5558	5548
24.4	5537	5526	5515	5504	5493	5482	5471	5460	5449	5439
24.5	5428	5417	5406	5395	5384	5373	5363	5352	5341	5330
24.6	5319	5308	5297	5287	5276	5265	5254	5243	5233	5222
24.7	5211	5200	5189	5179	5168	5157	5146	5135	5125	5114
24.8	5103	5092	5082	5071	5060	5049	5039	5028	5017	5006
24.9	4996	4985	4974	4963	4953	4942	4931	4921	4910	4899

* 3.5.6 (AF, N) Density Altitude. Compute density altitude (DA) as frequently as necessary to meet local needs, which are primarily in support of helicopter operations. Determine when DA is required and establish procedures locally for reporting data to using agencies (if entered on the telewriter system, it should follow the pressure altitude in the format "PA2848/DA3680"). The "Density Altitude Computer" (FSN 6660 955 0872) should be used to obtain DA.

a. Instructions for computing DA are printed on the reverse side of the computer.

b. The parameters needed for use with the computer are

(1) station pressure to the nearest 0.01" Hg (0.1mb) or pressure altitude to the nearest 10 feet,

(2) air temperature to the nearest whole degree (°C or °F), and

(3) dewpoint temperature to the nearest whole degree (°F).

c. Density altitude should be determined and reported to the nearest 10 feet.

3.6 Remarks. Significant changes in barometric pressure and its characteristics will be recorded and transmitted.

3.6.1 Pressure Falling Rapidly. Whenever the pressure is falling at the rate of 0.06 inch or more per hour with a total fall of at least 0.02 inch at the time of an observation, report "PRESFR" in remarks.

3.6.2 Pressure Jumps.

a. CRITERIA. Pressure jumps should be determined only at stations having a 12-hour microbarograph. They are indicated by a pressure rise at a rate exceeding 0.005 inch per minute and when all of the following criteria are satisfied:

(1) The rise is at least 0.02 inches

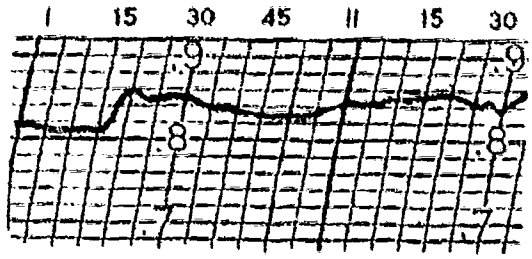
(2) The pressure for 20 minutes or more following the beginning of the jump remains at least 0.02 inch higher than at the beginning.

(3) The beginning of the jump is distinctly separated from the beginning of any preceding jump by at least 20 minutes, and by a segment of the trace having a rise less than 0.01 inch per two minutes, steady or falling.

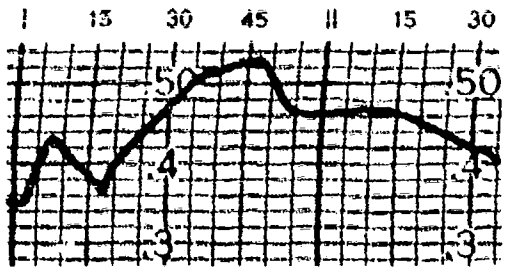
b. REPORTING. Whenever pressure jumps occur, report in remarks the contraction "PRJMP, followed by (1) magnitude of the jump in hundredths of an inch, (2) the time (GMT) that the jump began (see example) and (3) the time (GMT) that the jump ended. If sent as a special (see A2-3.7.2) repeat this remark on the next record observation. Do not transmit data ending more than two hours ago. Use slants to separate numerical data, e.g., "PRJMP 8/1612/18" where 8 is the magnitude of the jump (i.e., 0.08"), 1612 is the time when the jump began, and 18 is the time that the jump ended.

c. EXAMPLES:

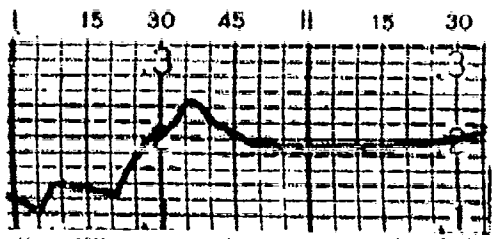
(1) From 1317 to 1319 CST, the pressure increased from 28.81" to 28.85" at a rate in excess of 0.005"/min. The pressure remained at least 0.02" higher than at 1317 CST for at least 20 minutes. This jump was coded in a special observation as PRJMP 4/1917/19. These data were reported again as remarks in the 1400 observation as PRJMP 4/1917/19.



(2) From 1302 to 1307 CST, the pressure increase satisfied requirement (1), but not (2). From 1318 to 1335 CST, (1), (2) and (3) were satisfied by an increase of 0.14" (from 28.37 to 28.51"). The jump was coded in a special as PRJMP 14/1918/35. It was sent in the 1400 record observation as PRJMP 14/1918/35.



(3) From 1305 to 1308 CST, the pressure increase (0.35") satisfied requirements (1), (2) and (3), therefore, it was coded in a special observation at 1328 as PRJMP 4/1905/08. The increase between 1322 and 1328 CST satisfied requirements (1) and (2) only, and the increase between 1331 and 1335 CST satisfied only requirement (1), therefore neither was reported.



3.6.3 Pressure Rising Rapidly. Whenever the pressure is rising at the rate of 0.06 inch or more per hour with a total rise of at least 0.02 inch at the time of an observation, report "PRESRR" in remarks.

3.6.4 Pressure Unsteady. This condition should be determined at stations having a microbarograph. It is indicated by sharp troughs or crests that depart at least 0.03 inch from the mean trend. Whenever this occurs, report "PRES UNSTDY" in remarks at the next observation.

3.6.5 Barogram V. The Barogram V, which is also termed "pressure V," should be determined at stations having a microbarograph. When the barogram indicates a fall in pressure at the rate of 0.06 inch or more per hour, followed by an abrupt rise at the rate of 0.06 inch or more per hour, and both the fall and rise each equal 0.03 inch or more; the lowest pressure in the V will be noted and reduced to sea level. The mean temperature used in the reduction will be determined in accordance with the following:

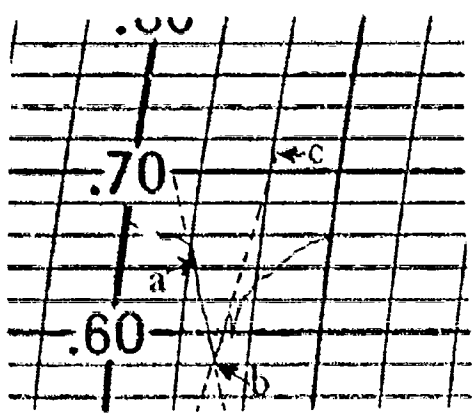
a. When a thermograph (or hygrothermograph) is available, select the temperatures corresponding to the time of the lowest pressure and to the time 12 hours before.

b. When a thermograph is not available, select the temperatures at the preceding observation and at a time 12 hours before.

3.6.5.1 Reporting.

a. Whenever a barogram V is observed, report as a remark at the next record observation, the lowest sea-level pressure in tens, units, and tenths of millibars, and time of occurrence, GMT (e.g., "LOWEST PRES 631 2343").

b. EXAMPLE



"a-b" represents a fall of approximately 0.07 inch at a rate of approximately 0.13 inch per hour. "b-c" represents a rise of approximately 0.03 inch at a rate of approximately 0.22 inch per hour.

3.7 Pressure Tendency. The barometric pressure tendency comprises two elements.

a. The net change within a specified time

b. The characteristic of the change during the period, based on

(1) The appearance of the barogram

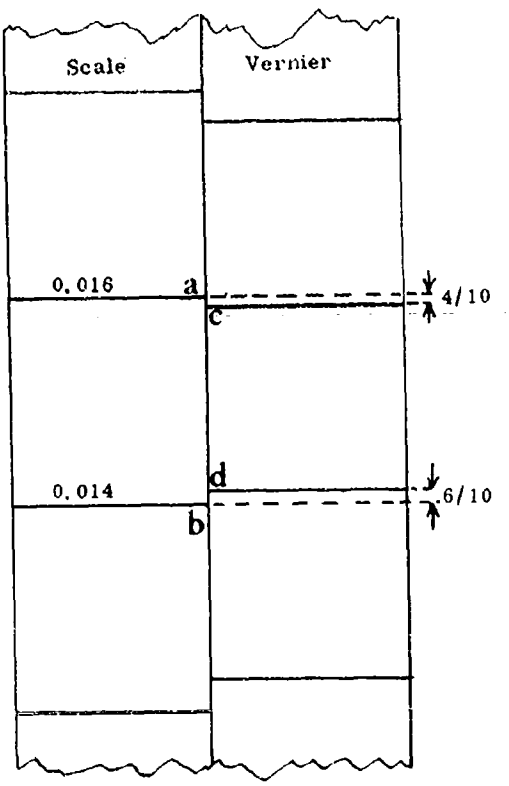
(2) The direction of change, if any (i.e., higher, lower, or no change).

3.7.1 Frequency. Pressure tendencies should be determined at the time of each 3- and 6-hourly observation at stations equipped with a microbarograph. Determine the elements from the trace for the full 3-hour period ending at the actual time of the observation.

3.7.2 Pressure Change. Determine the net change in station pressure for the preceding 3 hours to the nearest 0.005 inch by subtraction using the appropriate entries in column 17 of MF1-10. If an observation was not taken 3 hours earlier, determine the change from the barogram.

3.7.3 Pressure Characteristic. Classify the characteristic of the trace for the 3-hour period, using the code figure in table A3-12 corresponding to the same general pattern. When the tendency of the observed trace is incompatible with the sign of the net change select the tendency that is most nearly compatible with this sign. When fluctuations in the trace vary in amplitude, visualize a smoothed trace that contains not more than one peak or one valley, or in the event the trace contains more than one major fluctuation of approximately equal amplitude (e.g., one peak and one valley), the trace should be smoothed to reflect the trend of the most recent fluctuation. The most recent fluctuation usually is ignored when it is of relatively minor amplitude, as shown in table A3-12, example H opposite code figure 1 and example F, opposite code figure 0.

Scale-vernier ratio 24:25
Smallest interval 0.002 inch



a-b represents a scale increment of 0.002 inch, between values of 0.014" at b and 0.016" at a. b-d represents 6/10 of the difference between a vernier reading of 0.014" (when d is coincident with b) and a vernier reading of 0.016", i.e., 0.002" X 6/10 = 0.0012" (0.001" when rounded), giving a vernier reading of 0.014 + 0.001 = 0.015 inch.

Figure A8-3. Mercury barometer readings obtained from vernier.

4.1.6 Correction of Mercury Barometer Readings. Readings of mercury barometers should be corrected for scale error and capillarity, gravity, removal (i.e., the difference between the actual elevation of the barometer and the assigned station elevation), and any known residual errors. The sum of these corrections should be obtained from the barometer correction card as issued or verified by the pertinent regional headquarters or intermediate maintenance shop.

4.2 Station Pressure from Barographs.

4.2.1 Reading Barographs. Obtain readings from barographs as follows:

a. Tap the top of the instrument case lightly

b. Read current chart value to nearest 0.005 inch or 0.1 mb, interpolating for values lying between the printed ordinates

c. Algebraically add the correction determined in accordance with A3-2.65 to the value obtained in para. b. above, to obtain the station pressure.

4.2.2 Time Check. Make a time check on the barograph immediately after the 6-hourly correction has been determined. The line should be about equal in length to the width of two divisions on the chart and should be made carefully to avoid injury to the delicate mechanism of the barograph.

4.2.2.1 Do not make a time-check line whenever the instrument is cold enough that the pen might not return readily to the pressure trace because of increased viscosity of the fluid in the damper or dashpot.

* 4.2.2.2 (AF) AWS units will make time checks only when the barograph is the primary instrument used for routine station pressure measurements.

4.2.3 Clock and Chart Scale. Ascertain that the clock is running and the ink is flowing properly, and note the position of the pen on the chart. Whenever it appears that the pen will pass off the printed divisions of the chart, set the pen up or down, equivalent to one full inch of pressure, by means of the adjusting screw, renumber the lines accordingly.

4.2.3.1 (WB, FAA) Indicate on the chart the time of the adjustment (see figure A8-4).

4.2.4 Barograms. Change charts at 6-hourly times (0000, 0600 GMT, etc.) closest to noon LST. If changing the chart must be delayed, change it at the time of the next 3-hourly in order that the pressure-tendency record will be uninterrupted. On barographs with 12-hour gears, change the chart daily.

a. (WB, FAA, N) On barographs with 4-day gears, change the chart on the 1st, 5th, 9th, etc.

b. (AF) Change charts every 8 days and enter beginning date of trace.

e. (WB, FAA) Disposition. Forward completed barograms monthly with MF1-10 in accordance with A2-1.7.

4.2.5 Adjustment for Pressure. To adjust the position of the pen, turn the knurled pressure-adjusting knob at the top of the cylindrical pressure-element housing until the pen is at the correct station pressure. Tap the case or chassis lightly to overcome any sticking in the linkage mechanism before checking the adjustment of the pen. Adjust barograph to a zero correction when:

a. Chart is changed and correction exceeds 0.01 inch or 0.3 mb and

b. Correction exceeds 0.05 inch or 1.5 mb (see A3-2.65).

4.2.6 Adjustment for Time. To adjust the cylinder for time, turn it counterclockwise until all slack motion in the drive mechanism is removed. If the pen position does not bear the proper relationship to the time-ordinate lines after the slack has been removed, continue to turn the cylinder counterclockwise with sufficient force to override the friction drive until the timing error is eliminated. Adjust the instrument promptly if, at any time, the record trace is in error by more than 1/4 of a chart division.

* 4.3 (WB, FAA) Altimeter Setting from Aircraft-Type Altimeters. At stations equipped with one or more aircraft-type altimeters, use the following procedures to obtain the altimeter setting:

a. Turn the knob of the altimeter until the hands indicate the posted elevation-scale value determined in accordance with A12-5.2.6 if comparisons are made with a mercury barometer. If such comparisons are not made, use the actual elevation of the altimeter less 10 feet as the posted elevation-scale value.

b. Tap or vibrate the altimeter while resetting it to eliminate any lag due to friction in the mechanism.

c. Recheck the setting after vibration and reset if necessary.

d. Read the altimeter setting, in inches and hundreths, from the pressure scale which appears in a small window in the dial of the altimeter.

When two aircraft-type altimeters are used, adjust both instruments to the posted elevation-scale value and then read them at the same time. Use the lowest reading as the altimeter setting. However, if the difference between them exceeds 0.05 inch at non-precision approach locations, or exceeds 0.02 inch at precision approach locations, consider the altimeter setting missing.

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CHAPTER A9. TEMPERATURE AND HUMIDITY

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(b) Used as a standby when hygrothermometer dewpoint sensor is not operational

(c) Used when hygrothermometer dry-bulb sensor is not operational

(d) (WB, FAA) Used when telepsychrograph dry-bulb sensor only is operational (wet-bulb 33°F. or lower)

(e) (WB, FAA) Used when telepsychrograph is not in use (temperature is 20°F. or less).

c. Assume dewpoint (ice) to be the same as the dry-bulb, when temperature is -35°F. or lower, and compute the corresponding dewpoint with respect to water.

3.5.1 Dewpoint Equals or Exceeds Dry-Bulb. When dewpoints from the system in use equal or exceed the dry-bulb and the system in use is within operational limits; assume the wet-bulb and dewpoint to be the same as the indicated dry-bulb, unless ice fog is present.

3.5.2 Dewpoint During Ice Fog. When ice fog is present, assume the dewpoint with respect to ice to be the same as the dry-bulb and compute the corresponding dewpoint with respect to water. If the dry-bulb is obtained from a hygrothermometer, defer calibration checking while ice fog persists.

* 3.6 Relative Humidity Computations. When there is a local need for these data, determine values to the nearest percent using a psychrometric calculator, nomogram or table appropriate for the evaluation of the station.

3.7 (WB, FAA, N) Maximum and Minimum Temperatures. Obtain these values from appropriate available equipment and determine them to the nearest °F in accordance with the following.

3.7.1 Maximum-Minimum Extremes. Obtain values from maximum-minimum indicators in use (hygrothermometer or mercury- or spirit-in-glass thermometers) when properly reset for exposure throughout the 6-hourly period.

a. If for any reason a max or min indicator has not been properly exposed or reset for the observation period, disregard the indicated readings and

(1) (N) If the GMQ-14 semi-automatic weather system is inoperative, secure these data from standby equipment, if available, or the dry-bulb entries in column 7, MF1-10.

(2) (WB, FAA) If a thermogram is not available for determination of these data, obtain the max-min values from the dry-bulb entries in column 7, MF1-10.

(3) If none of the preceding procedures are possible, consider the value(s) missing.

3.7.2 (WB) Thermograph or Hygrothermograph. If values are not available from maximum-minimum indicators, determine the values from corrected recorder charts of thermographs or hygrothermographs.

3.7.3 (WB, FAA) Telepsychrograph. Determine these values from the recorder trace when the station standard system is a telepsychrograph within operational limits. Read maximum and minimum dry-bulb temperatures, for any specific period, on the portion of trace "1" recorded farthest to the right and left, respectively, during the period.

CHAPTER A10

WIND

1. General.

1.1 Content. Wind is measured in terms of velocity, a vector that includes direction and speed. The absence of apparent motion of the air is termed "CALM". The direction and speed of the wind should be measured in an unsheltered area. This will avoid, to a large degree, the measuring of wind directions and speeds which have been disturbed by local obstructions and will result in the reporting of winds more representative of the general weather patterns.

2. Definitions.

2.1 Wind. As used in this chapter, wind is the horizontal motion of the air past a given point.

2.2 Direction of Wind. Wind direction is defined as the direction from which the wind is blowing.

2.3 Variable Wind Direction. Wind direction is considered to be variable when it fluctuates by 30° or more during the period of observation.

2.4 Light Wind. The wind is considered to be light when the speed is 6 knots or less.

* 2.5 Gust. Rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls.

* 2.6 Squall. A sudden increase in wind speed of at least 15 knots and sustained at 20 knots or more for at least 1 minute.

2.7 Wind Shift. A term applied to a change in wind direction of 45° or more which takes place in less than 15 minutes.

2.8 (WB) Fastest Mile. The fastest speed, in miles per hour, that one "mile" of wind passes the station.

2.9 Variation. Variation is the angle between true north and magnetic north. It is either "east" or "west" according as the compass needle points to the east or west of the geographical meridian.

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CHAPTER A11

PILOT REPORTS

1. General.

1.1 Content. This chapter pertains to the recording and encoding of the PIREP message. The inclusion of pilot reports in aviation observations is covered in chapter A5 of this handbook. Since these reports are a valuable source of information, not otherwise available, they should be obtained from pilots in any way possible and disseminated whenever available.

2. Definitions. Reports of meteorological phenomena encountered by aircraft in flight are called pilot reports (PIREPS).

3. Encoding PIREP Messages. To prepare a PIREP message for transmission, report distances in nautical miles and heights in hundreds of feet as reported by the pilots. (Note pilots report heights, when above 18,000 feet, are based upon standard atmospheric relationships.) The elements and their order in the message are: station identification, message identifier, and text of message.

3.1 Station Identification. Use the station call letters, international block and index numbers, or latitude and longitude of the station in that order.

3.2 Message Identifier. Enter the contraction "PIREP".

3.3 Text of Message. Several pilot reports may be combined in the text of a PIREP message to avoid repetition of the station identifier, PIREP, etc. The data will be entered as follows:

3.3.1 Location and/or Extent. Enter the location and/or extent of phenomena relative to a nationally known weather reporting site. Express distances in nautical miles. For example a PIREP received at Dover AFB with a location given as over SIE should be encoded as 47E DOV.

3.3.2 Time. The time, GMT, the phenomena were actually observed, if known.

3.3.3 Phenomena. Insofar as is known, data will be reported as follows for the following phenomena:

a. Clear-Air Turbulence. Enter intensity, the contraction "CAT," proximity of clouds, duration (if known), height of phenomenon, and type of aircraft. When negative CAT is reported use the contraction "CAT NONE" in the report.

b. Condensation Trails. Enter "CONTRAILS" followed by their height and type of aircraft.

c. Duststorm or Sandstorm. Enter "DUSTSTORM" or "SANDSTORM", height of aircraft and the horizontal visibility in the obscuration if aircraft is in the obscuration, and the height of the top of obscuration if known.

d. Electric Discharge. Enter "DISCHARGE" followed by altitude and type of aircraft.

e. Smoke or Haze Layer. Enter "KLYR" or "HLYR" followed by the height of the phenomenon and "VSBY" followed by the horizontal visibility within the layer.

f. Hail. Enter the term "HAIL" followed by the height at which hail was encountered.

g. Icing. Enter intensity (TRACE, LGT, MDT, SVR), type (CLR, RIME, MXD), the contraction "ICG," the height icing is encountered and the type of aircraft.

* h. Lightning. Enter frequency (OCNL, FQT), followed by LTGIC, LTGCC, LTGCG, LTGCA as appropriate.

i. Sky Cover. Enter the appropriate sky cover symbol preceded by the height of the base and followed by the height of the top. Enter "U" if a sky cover symbol is unknown. If the aircraft is in the clouds, enter "INC" and the height of the aircraft.

j. Thunderstorm. Enter areal coverage (ISLTD, FEW, SCTD, NMRS) or if storms are reported in a line, enter description (LN, SCTD LN, BKN LN, SLD LN). Follow areal coverage with the contraction TSTM(S), the orientation of storms, height of the base and tops, and type of lightning.

k. Tornado, Funnel Cloud and Waterspouts. Enter "TORNADO, FUNNEL CLOUD or WATERSPOUT" as appropriate, the direction of movement, the height and amount of parent cloud and any information considered significant.

l. Turbulence (other than clear air). Enter intensity (LGT, MDT, SVR, EXTRM), followed by "CHOP" or "TURBC," whichever is reported, the height of the turbulence and type of aircraft.

* m. Wind. Use the contraction "WND," the true direction to the nearest ten degrees and speed in knots, and the height of the reported wind.

5. Dissemination. All pilot reports should be given local and longline dissemination as a PIREP except:

a. When two or more reports have substantially the same information, disseminate only the most recent.

b. Reports of sky condition which have been incorporated into a record or special observation (see chapter A4). When a pilot report is sent as part of a special, the data will be included in the next record observation unless later information indicates that it is no longer valid.

c. Data need not be disseminated locally when they are substantially the same as data transmitted within the past 30 minutes.

* 5.1 (AF) PIREP Evaluation. Pilot reports will be evaluated by the forecaster to determine the need for longline dissemination, except as follows:

a. Cloud height values entered in the aviation observation (columns 3 and/or 13, AWS Forms 10 and 10a).

b. Hazardous phenomena (see paragraph 5.2 below).

When a forecaster is not on duty, all pilot reports will be disseminated locally and longline, except for those that duplicate previously disseminated reports or reports containing only cloud height data used in the aviation observation. If determined to be desirable locally, procedures may be established whereby a forecaster evaluates all PIREPS prior to local dissemination except those PIREPS received by the ROS observer.

5.2 Hazardous Phenomena. Pilot reports containing the following weather phenomena will be given immediate local dissemination and transmitted as weather warning bulletins on longline teletypewriter circuits in accordance with appropriate communications manuals.

a. Tornadoes, funnel clouds, and waterspouts (also see ¶A7-3.1)

b. Severe or extreme turbulence

c. Hail

d. Severe icing.

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CONTENTS

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TABLES

FIGURES

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CHAPTER A12

OPERATION OF EQUIPMENT

1. General.

1.1 Content. This chapter contains instructions for the operation of meteorological instruments and related equipment. Each of the sections of this chapter pertains to an element in the observation. These elements are arranged in the same order as in chapters A5 through A10. Thus, section 2 pertains to ceiling measuring instruments, section 3 to visibility measuring instruments, etc.

1.2 (AF) Operating Instructions. Each unit will maintain a current operating technical order (TO), or appropriate portion thereof, with or near the associated observing equipment for easy reference.

2. Cloud Height Instrumentation Operating Procedures.

2.1 Preparation of Sky Cover Height Tables. Prepare sky cover height tables as follows:

a. Compute tables for each ceiling light and ceilometer baseline on the basis of $h = b \times \tan \theta$; where "b" is the baseline, "θ" is the angular reading and "h" is the sky cover height or vertical visibility.

b. Add algebraically the difference between the height of the observation site and the field elevation to each tabular value. Use ground elevation for stations not located at airports.

c. Round each of these sums to the reportable height increment listed in table A3-2.

d. Separate tables need not be prepared for multiple ceilometer installations with identical baselines when the difference in the height of the projector trunnions (rotation pivots) is less than 10 feet.

* 2.2 Period of Ceilometer Operation. Operate the ceilometer in accordance with the following:

a. When clouds within the height determination capability of the instrument or fog are present, or are forecast or expected to be present within 3 hours.

b. When a local need exists for operation of the instrument.

c. If none of these conditions exist, and are not expected to occur within 3 hours, place the ceilometer in a standby status.

2.2.1 (WB, FAA) Detector Operation. Do not turn off the detector of the fixed beam ceilometer.

2.3 (WB, N) Ceilometer Recorder. The Alden Ceilometer Recorder gives a continuous and permanent record of cloud height. The record is made on special paper and the marking is accomplished electrically. Since conditions of clouds and visibility vary considerably, each observer under the guidance of a more experienced observer or an electronics technician should experiment with the controls of the RBC recorder until he becomes familiar with the effects produced by changes in settings.

2.3.1 Starting Procedure. To start the RBC recorder:

a. Push Master AC switch on.

b. Wait 30 seconds. If System Start panel indicator light comes on, it indicates that the System Start switch has been left in the ON position and the recorder is not synchronized with the projector. In such case, push System Start switch to OFF (panel light off). Wait until Helix drum stops. (Chart illumination light off.)

c. Push System Start switch to ON position. (Panel light on) (When Helix drum starts, chart illumination will turn on.)

d. Check synchronization. When checking the synchronization of the recorder to the projector, the DARK MAX should be OFF, and the SIGNAL LEVEL CONTROL and the TONE LEVEL CONTROL should be in the extreme counterclockwise, "OFF" position. Coarse synchronization of the recorder and projector is accomplished when the zero pulse from the projector prints over or near the zero degree mark of the recorder. If out of synchronization, the zero projector pulse may print anywhere on the trace.

e. Calibrate Recorder. Fine calibration of the recorder to the projector is accomplished by adjusting the zero degree mark of the recorder so that it is centered on the zero projector pulse (the zero projector pulse is the longer of the two). Fine calibration is achieved by adjusting the lever located on the left side of the recorder. Move the lever up to move the zero degree mark of the recorder to the right.

f. Set signal level in accordance with the following:

Max Indicated Signal Voltage at Meter	Signal Level Control
0 - 2 volts	5 - 10
2 - 6	4 - 8
6 volts and above	1 - 4

Note: The meter readings are used merely as a guide. Signal level settings of individual recorders may not always follow the table.

3. Visibility Instrumentation Operating Procedures.

3.1 Transmissometer Operation. Operate the transmissometer in accordance with National Bureau of Standards Report No. 2588 (Revised) and separate instructions. Where they differ, the separate instructions will take precedence, within the service(s) concerned, over the National Bureau of standards instructions.

3.1.1 (AF) Transmissometer Period of Operation. The transmissometer will be operated continuously.

* 3.1.2 (AF) RVR Computing Set Operation. Operate the set in accordance with the following:

a. When visibility is two miles or less or is forecast to be reduced to two miles or less within three hours.

b. When a local need exists.

c. If none of these conditions exist, or are not expected to occur within three hours, the set may be turned off.

3.2 (WB, FAA) Adjustments and Calibration Checks.

3.2.1 Tower Notification. Notify the tower and TRACON immediately of performance checks (including daily and weekly checks), or adjustments such as background adjustments and zero adjustments that are likely to affect their readings of runway visibility or runway visual range.

3.2.2 Background Measurements and Adjustments. These instructions are applicable at transmissometer stations not equipped with RVR computers. Separate instructions will be supplied for use at computer installations. "Background Level" measurements should be made whenever it is likely that the background level may be great enough to invalidate the RVV or RVR values determined from the equipment.

3.2.2.1 Method of Measurement. "Background Level" measurements are made as follows:

a. Depress the BACKGROUND switch to the TEST position

b. Read the indicated value of the adjacent recorder trace

c. Release the switch button (to return it to NORMAL position).

d. If the reading in "b" exceeds 1 percent of full-scale value, adjust the ZERO ADJUSTMENT control, as necessary, to reduce the reading to near zero.

3.2.3 Daily and Weekly Checks. In addition to the background measurement specified in §3.2.2, see appropriate separate instructions.

3.2.4 Readout Check. Check concurrent readings of all readouts, (usually in Tower, TRACON and WB) once during each 8-hour shift. Simultaneous readings made with the assistance of TRACON or tower personnel should conform to the following standards:

a. RVR computer readouts should display identical values at all positions and normally should agree within one reportable value with concurrent values derived from the recorder trace and appropriate tables.

b. RVV meter readouts should display approximately identical values at all positions. Meter recorder comparisons are made with the system in a test condition, as follows, and involve the controls on the indicator panel:

(1) Inform meter readout positions of the beginning of the test period.

(2) Switch the ZERO control to TEST position.

(3) Use the ZERO ADJUSTMENT control, if necessary, to zero the recorder.

(4) Obtain meter readings from all positions in terms of the ± departure of each meter needle from the "0" graduation of the meter scale in terms of the width of the needle separating the night and day scales. Departures should not exceed ±0.5, i.e., a departure equal to one needle width.

(5) Reset ZERO switch to NORMAL.

(6) Set the CALIBRATE switch to CALIBRATE.

(7) Adjust the CALIBRATE ADJUSTMENT control for a recorder reading as follows:

	Transmissometer Conversion Values					
	Runway Visual Range			Runway Visibility		
	250 ft. Baseline	500 ft. Baseline	750 ft. Baseline	250 ft. Baseline	500 ft. Baseline	750 ft. Baseline
Recorder Readings	91.8	84.3	77.4	90.9	82.6	75.1
Meter Equivalents on DAY Scale	6000 ft.			1 7/16 mile (the graduation separating the 1 3/8 and 1 1/2 mile increments)		
Percent of Full Scale	100			99.2	98.6	98

(8) Obtain meter readings from all positions in terms of the + departure of each meter needle from the 1 7/16 mile DAY scale graduation mark on the meter face. The meter needles should not depart from the specified graduation by more than four needle widths.

(9) Adjust the CALIBRATION ADJUSTMENT control until the recorder reading is 90.0 and reset the CALIBRATE switch to NORMAL.

(10) Inform the meter readout positions of the end of the test.

(11) Discontinue the use of meters that do not agree with calibrated recorder readings within the limits specified above. Notify the responsible electronics technician of meters that fall outside these limits.

3.3 Transmission Variation. Almost all short term fluctuations of runway visibility or runway visual range as displayed or the recorder and applicable meter or computer readout are real. The transmissometer is very sensitive to the varying light transmission characteristics of the atmosphere; variations which occur particularly under low visibility conditions. For this reason, caution must be used in rejecting visibility or visual range values as erroneous. A lamp which is failing can cause false transmission variations (see separate instructions applicable to the agency).

3.4 (WB, FAA) Equipment Outage. The FAA is responsible for monitoring the performance and determining the operational status of all RVR/RVV systems not an integral part of an AMOS, for removing from and restoring to service such systems, and for advising all concerned of such actions. Whenever a malfunctioning is suspected arrangements will be made for

necessary electronic performance and visual checks on the system including, if feasible, a comparison of indicated values with conditions in the area of the transmissometer. If the malfunctioning is obvious or is verified by the checks, the system will be taken out of use until repairs are made. Upon removal of the system from service the following action will be initiated:

a. Notify immediately all readout positions (either RVR or RVV) that data are no longer valid and shall not be used.

b. Notify the responsible electronic technician of the malfunction as quickly as possible.

c. Enter a notation of the outage on the FAA maintenance form; show the date and time the system is taken out of service.

3.5 (WB, FAA) Equipment Restored to Service. When the FAA determines the system has been restored to operational status and returns it to service, all readout positions will be notified that RVR or RVV data may now be used and an appropriate notation will be made on the FAA maintenance form showing the date and time the system was placed back in service.

might affect the reliability of the readings. The pressures determined are adjusted to a single elevation. The established practice is to apply the correction for the difference in elevations to the pressure at the airport station(s) if there is one. Obtain this correction for difference in barometer elevations from Form WBAN 54-6.5 (formerly WB 1060), using as temperature argument the mean of the outdoor temperatures at the two offices at the beginning and ending of the comparisons. If the difference in elevation is greater than 100 feet, both the mean temperature and existing station pressure are used to determine the correction. Comparisons need not be made if the difference in the elevation of the barometers exceeds 200 feet. The Form WBAN 54-6.5 is usually prepared by the Weather Bureau Headquarters but in an emergency the correction may be prepared by regional headquarters or station personnel.

5.2.9 (WB) Disposition of Form WB Form B-1. Send the original copy to your regional headquarters for forwarding to Weather Bureau Headquarters. Retain a copy at the station. Prepare and forward other copies if required by regional instructions.

5.2.10 (WB) Disposition of MF1-13. Comparative data entered on "Barometer Comparisons, MF1-13," will be filed at the originating stations. A representative of the regional headquarters will periodically review the data and discard any of the forms which are more than 18 months old and are no longer needed.

* 5.2.11 (AF) Disposition of AWS Form 85. Completed AWS Forms 85, "Barometer Comparisons," will be casefiled by the originating station and retained as permanent records with the aneroid barometer. This file will be destroyed when the instrument is returned to supply or maintenance channels, and a new file will be established for the replacement aneroid barometer.

FEDERAL METEOROLOGICAL FORM 1-13 BAROMETER COMPARISONS

(MODIFIED FORM FOR USE AT AWS STATIONS)

(See detailed instructions for preparation of form on reverse side.)

STATION: Example AFB

LOCATION (State or Country): Illinois

COMPARISON OF ANEROID BAROMETER — SERIAL NO: 110

MERCURY BAROMETER SERIAL NO: 37 (ML-512)

ACTUAL ELEV. MERC. BAR., H_Z = 32.3 FT. — STATION ELEVATION, H_P = 32.0 FT.

ACTUAL ELEV. ANEROID BAR., E = 34.5 FT.

SUM OF MERCURY BAROMETER CORRECTIONS FROM DD FORM 744: −0.020

COMPARISON NO	YEAR 19 70 — MONTH AND DAY	TIME (LST)	DATA BASED ON MERCURY-BAROMETER: TEMP. ATTACH THERM	OBSERVED BAROMETER READING	STATION PRESSURE	STATION PRESSURE	OBSERVED ANEROID READING	CORRECTION (C_a)	SUM OF C_a FOR GROUP	COMP. NOS.	MEAN C_a FOR GROUP ($\bar{C}_a$)	DIFFERENCE BETWEEN SUCCESSIVE MEANS	REMARKS: A	REMARKS: B
1	2	3	4	5	6	7	9	10	11		12	13	14	
		90th	°F	in. H_g	in	mb.	in. H_g	in. H_g	in. H_g		in. H_g			
119	2/12	0541	71.0	29.993	29.857		29.857	000					29.858	−.001
120	2/12	1140	73.0	29.958	29.827		29.826	+.001	+.105	11-120	+.001		29.827	000
121	2/13	0537	72.0	29.648	29.521		29.519	+.002					29.520	+.001
122	2/13	1141	74.0	29.595	29.473		29.473	000					29.474	−.001
123	2/14	0543	73.0	29.379	29.250		29.249	+.001					29.250	000
124	2/14	1142	75.0	29.366	29.232		29.231	+.001					29.232	000
125	2/15	0531	72.5	29.694	29.565		29.564	+.001					29.565	000
126	2/15	1150	73.0	29.917	29.786		29.784	+.002					29.785	+.001
127	2/16	0556	70.0	30.248	30.124		30.123	+.001					30.124	000
128	2/16	1135	71.0	30.539	30.212		30.212	000					30.213	−.001
129	2/17	0538	74.5	30.411	30.285		30.284	+.001					30.285	000
130	2/17	1145	72.0	30.422	30.292		30.290	+.002	+.116	11-130	+.001		30.291	+.001
DI	SCON T	INUE	DAILY COMPARISONS — BEGIN WEEKLY COMPARISONS (EVERY TUESDAY AT THIS STATION)											
131	2/24	0535	71.0	30.176	30.049		30.048	+.001						
132	2/24	1140	71.5	30.108	29.981		29.981	000	+.011	*	+.001		*Nos. 37-38, 101-102, 115-116, 127-132	
133	3/3	0544	71.0	29.733	29.608		29.607	+.001						
134	3/3	1150	73.5	29.866	29.737		29.735	+.002	+.012	*	+.001		*Nos. 101-102, 115-116, 127-134	
135	3/10	0553	71.5	30.577	30.448		30.459	*−.010	—	—	—		*Omit from sums and means	
135a	3/10	0610	71.5	30.586	30.457		30.456	+.001						
136	3/10	1142	73.0	30.563	30.435		30.433	+.002	+.012	*	+.001		*Nos. 115-116, 127-134	
137	3/17	0530	70.5	30.563	30.437		30.436	+.001						
138	3/17	1139	72.0	30.418	30.288		30.286	+.002	+.013	127-138	+.001			
139	3/24	0540	73.0	30.095	29.964		29.964	000						
140	3/24	1140	72.0	30.186	30.057		30.058	−.001	+.009	131-140	+.001			
141	3/31	0536	72.5	29.861	29.732		29.731	+.001						
142	3/31	1133	75.0	29.840	29.704		29.702	+.002	+.011	133-142	+.001			
143	4/7	0541	70.0	30.254	30.130		30.129	+.001						
144	4/7	1137	71.0	30.044	29.918		29.917	+.001	+.010	135-144	+.001			

AWS FORM SEP 69 85 PREVIOUS EDITION OF THIS FORM MAY BE USED.

Figure A12-2. (AF) Example Daily and Weekly Barometer Comparisons

GUIDE FOR PREPARING FORM *

Headings Enter appropriate heading information and enter units under column numbers (e.g., °F or °C in column 4, inches Hg in column 5, etc.)

Col 1 Enter comparison numbers consecutively. Append letters (a, b, ...) to special comparisons following a regular one on the same day.

Col 2 Enter year at the top of column. Enter month and day (e.g., 2/5 for February 5).

Col 3 Enter time to nearest minute (e.g., 1912 for 7:12 P.M.).

Col 4 Enter temperature of attached thermometer to nearest 0.5 °F or 0.2 °C.

Col 5 Enter to nearest .001 inch or .01 mb.

Col 6 Enter to nearest .001 inch if mercury barometer is graduated in inches.

Col 7 Enter to nearest 0.1 mb if mercury or aneroid barometer is graduated in mbs.

Col 8 Not used.

Col 9 Enter observed reading of the aneroid barometer to nearest .001 inch or 0.1 mb., interpolating between scale gradations as necessary.

Col 10 Enter the difference between station pressure and observed aneroid reading. (Col 6 minus Col 9 or Col 7 minus Col 9)

Col 11 Under "Sum of C_a for group" : After making the second comparison of the day, add the values for that day to the values for the previous weeks (or days) and enter the sum of the values. Under "Comp Nos." enter the first and last comparison numbers used to determine "Sum of C_a for group" if numbers are consecutive. Enter all nonconsecutive numbers in Col 14.

Col 12 Enter to nearest .001 inch or .01 mb, the mean C_a based on the sum given in Col 11.

Col 13 Not used.

Col 14 Enter appropriate remarks (e.g., sums and differences used with study of drift, notes pertaining to corrective measures applied to instruments, etc.).

* FREQUENCY: For established instruments – two observations a day at 6-hour intervals, on the same day of every week.

For *newly* installed instruments – two observations a day at 6-hour intervals daily until considered reliable in accordance with the Surface Observations Handbook (FMH 1).

Figure A12-3. (AF) Back of AWS Form 85

6. Temperature and Humidity Instrumentation Operating Procedures.

6.1 Dry-bulb Thermometer. When driving rain or snow is occurring, dry the bulb and shield it from the precipitation as long as necessary to permit dissipation of extraneous heat before reading it again. Use this reading for psychrometric purposes rather than the reading normally made when lowest wet-bulb reading is taken. When frost forms on the thermometer, remove it with a warm cloth and allow sufficient time for the dissipation of extraneous heat before reading the thermometer.

6.2 Wet-bulb Thermometer.

6.2.1 Moistening the Wet-bulb. The procedure used in moistening the wet bulb varies according to whether the dry-bulb temperature is above freezing, near, or below freezing, and whether the relative humidity is high or low.

6.2.1.1 Temperature Above Freezing. Moisten the wet-bulb with clean water just prior to ventilating the psychrometer (even though the humidity is high or the wick already appears wet). If, however, the temperature is high and the relative humidity is low, or it is expected that the final temperature of the wet-bulb will be 32° or less, moisten the wet-bulb thoroughly several minutes before taking a reading so that a drop of water will have formed on the end of the bulb. This procedure will reduce the temperature of the wet-bulb without danger of the wick drying out before the temperature reaches its lowest point.

6.2.1.2 High Temperature and Low Humidity. In areas where the temperature is high and the relative humidity low, use precooled water for moistening the wet-bulb to avert premature drying of the wick. Water can be precooled for this purpose, by storing it in a porous jug. To avoid altering moisture conditions in the shelter, do not keep this jug in the shelter. If this method should not be effective, extend the wick from the wet-bulb to an open container of water and keep the end of the wick immersed in water between observations. When the psychrometer is ventilated, remove the wick from the water until the wet-bulb thermometer has been read. Regardless of the method used, ventilate the psychrometer in accordance with §6.3 before determining the wet-bulb temperature.

6.2.1.3 Temperatures Below Freezing. At wet-bulb temperatures below 32°F, if the wick is not frozen touch it with clean ice, snow or another cold object to induce freezing. If the observer is still unable to induce freezing of the wick, use the low temperature range of the psychrometric calculator for the computation of psychrometric data.

6.2.1.4 Dry-bulb Temperature Below 37°F. At dry-bulb temperatures of 37°F or below, use water that has been kept at room temperature in order to melt completely any accumulation of ice on the wet-bulb. Moisten the bulb

thoroughly, at least 15 minutes before ventilating the psychrometer, and longer if necessary to permit the latent heat, released if the water freezes, to be dissipated before ventilation is begun. Do not allow excess water to remain on the wet-bulb, since a thin, thoroughly cooled coating is necessary for accurate data.

6.3 Psychrometer Ventilation. Ventilate the psychrometer for about 10 seconds. The minimum speed of air passing over the psychrometer bulbs should be 15 feet per second. This is approximately one revolution per second of the geared (2 to 1 ratio) whirling psychrometer crank, two revolutions per second of the sling psychrometer, and three and one-half revolutions per second of the crank of the psychrometer fan or motor (direct-drive) whirling psychrometer.

6.3.1 Sling Psychrometer Ventilation. Ventilate the sling psychrometer as follows:

a. Select a shady spot with no obstructions within a radius of the whirling sling

b. Face into the wind

c. Hold the handle at arm's length while whirling the psychrometer.

6.3.2 Obtaining Readings. After proper ventilation has been achieved quickly read both thermometers, wet-bulb first. Repeat until two successive wet-bulb readings are the same, indicating that the wet-bulb temperature has reached its lowest point. If the wet-bulb temperature rises between successive readings, remoisten the wick and reventilate. Accurate readings are especially important at low temperatures, where a given wet-bulb depression has a greater effect on the accuracy of psychrometric computations.

6.4 (WB, FAA) Corrections. Apply corrections to all dry- and wet-bulb thermometer readings under conditions a. and b., and to all wet-bulb thermometer readings under condition c. These conditions are:

a. Whenever the temperature indicated by the thermometer is above 42°, and the instrumental correction is +0.3° or more in the case of mercury thermometers or +0.5° or more in the case of spirit-filled dry-bulb thermometers.

b. Whenever the temperature indicated by the thermometer is 42° or less.

c. Whenever the wet-bulb thermometer has an indicated reading higher than that of the dry-bulb thermometer. If the reading of the wet-bulb thermometer, after the correction has been applied, remains higher than the dry-bulb reading, disregard it and use the dry-bulb value for both temperatures.

6.4.1 Correction cards are furnished for calibration intervals of 10° or 20°. Interpolate between calibration intervals for a correction to an observed reading. Tables or graphs for this purpose may be prepared locally. Add the appropriate correction algebraically to the reading of the thermometer.

EXAMPLES

Reading of the thermometer------	62.1
Correction to be applied--------	-0.5
Corrected reading----------	61.6
Reading of the thermometer------	-8.2
Correction to be applied--------	-1.2
Corrected reading----------	-9.4
Reading of the thermometer------	+0.4
Correction to be applied--------	-1.2
Corrected reading----------	-0.8

6.4.2 The supplying of correction cards for maximum and minimum thermometers has been discontinued. If they are available, they need not be used in determining temperature extremes.

6.5 (WB) Thermograph or Hygrothermograph.

6.5.1 Time-Check Lines. At each 6-hourly observation, make a time-check mark on the trace by raising the pen the width of two printed temperature intervals.

6.5.2 Changing Charts. Change charts on 7-day thermographs on the 1st, 8th, 15th, 22nd, and 29th of the month, at 0800 LST or as soon thereafter as practicable, except stations obtaining hourly temperatures from the thermogram for entry on MF1-10 or WB Form 610-10 may change them on Fridays to conform with mailing instructions. Before placing the chart on the thermograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

a. In the upper left-hand corner, or in spaces provided, enter the station name and type (WBO, WBFO, etc.), meridian of local standard time and, on the first of the month, the time that the pen is touched.

b. Across the top of 7-day charts at each noon line, enter the corresponding date.

c. Above the point where the trace will begin, enter the dry-bulb temperature to whole degrees and the time of beginning to the nearest minute.

6.5.3 To change the chart move the pen aside with the shift rod and lift the cylinder until it is clear of the spindle. Wind the clock and replace the chart. Be sure that the bottom of the new chart rests against the shoulder of the drum and that the chart fits the drum snugly, with both ends under the spring clip. The horizontal lines should coincide where the ends overlap. Replace the cylinder on its spindle, and adjust the position of the chart for time and temperature before replacing the pen on the chart.

6.5.4 After removing the chart:

a. Enter the time of any adjustment, an arrow indicating the point of adjustment, and the dry-bulb temperature if adjustment other than that for time has been made.

b. Above the end of the trace, enter the time of removal and the dry-bulb temperature to whole degrees at the time the pen was lifted from the chart.

c. At first-order WB stations enter above the time-check lines, the difference (to whole degrees with proper algebraic sign) between the thermograph reading and the corresponding dry-bulb reading; above the point of maximum and minimum temperatures for the day, enter similarly the difference between the thermograph readings and the corresponding readings of the maximum and minimum thermometers in the same shelter. Example: maximum temperature from col. 66 of MF1-10, 48°/ maximum temperature from thermograph trace for the corresponding time, 50°; correction entered on the thermogram, -2.

6.5.5 Time Adjustment. Adjust the chart for time by turning the cylinder until the pen point is slightly to the right of the appropriate time-arc line on the chart. Take up the play in the gear mechanism by holding the top edge of the cylinder lightly and turning it counter to the direction of normal rotation until the pen point indicates the correct time. Adjust the instrument promptly if at any time the record trace is in error by more than 30 minutes on a 7-day thermograph, or 10 minutes on a 1-day thermograph.

6.5.6 Temperature Adjustment. When the chart is changed, adjust the thermograph to the dry-bulb temperature, if necessary, by means of the adjusting screw located on an extension of the pivoted end of the sensing element. During the process, tap the instrument lightly to eliminate transient frictional effects in the linkage mechanism. Adjust the instrument promptly if, at any time, the recorder trace is in error by more than 5°. When it appears that the pen will pass off the printed divisions of the chart, set the pen up or down equivalent to 10° or 20° by means of the adjusting screw, renumber the lines accordingly, and indicate on the chart the time of the adjustment. If after adjustment to any intermediate temperature, the thermograph reads too low at the time of daily maximum temperatures, and too high at the time

of daily minimum temperatures, the pen arm is swinging over too small an arc. To lengthen the pen arm, turn the length-adjusting nut in the direction that moves the fulcrum to the left. Conversely, if the recorded temperature is too high at the time of maximum temperatures and too low at the time of minimum temperatures, shorten the pen arm by turning the adjusting nut in the opposite direction.

6.5.7 Disposition. Forward completed thermograms or hygrothermograms for the month, including the one ending at 0800 LST on the first of the following month, to the NWRC not later than the second working day of the following month. Assemble the charts in chronological order with the first day of the month on top.

6.6 (WB, FAA, N) Resetting Maximum and Minimum Thermometers.

6.6.1 Maximum Thermometer. Before resetting the maximum thermometer be sure that the mercury column is resting on the constriction at the base. Otherwise, the glass forming the constriction may be broken when the thermometer is spun. To reset it, spin the thermometer until its reading is the same as that of the dry-bulb temperature. If the readings of the dry-bulb and maximum thermometer disagree, check the thermometers for the source of error in accordance with maintenance instructions. Lock the thermometer in place on the support. Whirl and reset the maximum thermometer at each 6-hourly and midnight observation.

6.6.2 Minimum Thermometer. Reset the minimum thermometer after the maximum thermometer has been reset by turning it to a vertical position and holding it bulb-end up until the index reaches the end of the column and the reading is the same as the dry-bulb temperature.

6.6.2.1 Disagreement of Dry-Bulb and Minimum Thermometer Readings. If the readings of the minimum and dry-bulb thermometers disagree, check the thermometers for the possible source of error in accordance with ¶6.6.2.2 or separate maintenance instructions. Return the thermometer to its correct position. Reset the minimum thermometer at each 6-hourly and midnight observation.

6.6.2.2 Erroneous Readings. Minimum thermometers are subject to errors caused by separation of the spirit column. Sometimes the spirit vapor condenses in the upper end of the bore to form one or two short segments above the rest of the column. At other times, bubbles that form in the column may trap the index. Erroneous readings will result in both cases, and therefore, the thermometer should be examined at each observation for separation of the column. Errors also result from recession of the index owing, chiefly, to the shelter being jarred or subjected to vibration by the wind.

6.7 (WB, FAA) Recording Telepsychrometer (Telepsychrograph). The recording telepsychrometer measures dry-bulb temperatures and wet bulb

depressions. The L & N (Leeds and Northrup) resistance measuring, multiple-point type of instrument measures dry-bulb temperatures from 20° to 120°, and wet-bulb depressions from 0° to 50° at dry-bulb temperatures above freezing. The two basic units of this telepsychrometer are the sensing unit and the recorder.

6.7.1 Sensing Unit. The sensing unit contains two continuously ventilated resistance thermometers, called thermohms, which correspond to the dry- and wet-bulb thermometers of mercurial psychrometers. One of the thermohms is covered by a wick that is partially immersed in a tray of water automatically replenished from a conical reservoir. To gain access to the thermohms and reservoir, loosen the knurled nuts on each of the three supporting legs near the bottom of the cylindrical housing. Turn the housing slightly before lowering it over the legs.

6.7.2 Recorder. At approximately 1-minute periods, the recorder prints alternately the current dry-bulb temperature and the depression of the wet-bulb on a chart whose vertical lines represent 1° intervals of dry-bulb temperature and 0.5° intervals of depression. The dry-bulb temperature trace consists of a dot and the figure "1" printed simultaneously. The wet-bulb depression trace consists of a dot and the figure "2." The time (LST) is indicated on the chart by the horizontal lines identified by the figures 0 to 23 printed near the left margin.

6.7.3 Recorder, Additional Information. A complete description of the recorder mechanism, charts, and details of operation and maintenance, will be found in the L & N booklet furnished with the recorder. The small calibration dial in the upper left corner of the recorder should not be adjusted except by a technician. To reduce the chance of accidental movement of the dial, use scotch tape to fasten it securely against the recorder chassis.

6.7.4 Annotation of Telepsychrometer Charts. Annotate charts as follows:

a. At each 6-hourly observation, enter a short line followed by the notation "6H" to the right of the dry-bulb reading.

b. Each day, stamp the month, date, and year on the extreme right side of the form near the noon time line.

c. At the time the form is removed from the recorder, enter the station name and the date of beginning and ending of the record at the end of the traces and approximately midway between the margins of the form. Beneath the station name and near the end of the traces, identify the ordinates of the wet-bulb depression and dry-bulb scales by labeling them in increments of 10°. Identify the scales as "1-dry bulb" and "2-depression."

6.7.5 Time Adjustment. When a new roll of paper is first installed, or when the record is incorrect with respect to time, adjust the paper for time by turning the upper cylinder on the recorder, and enter the local standard time of the adjustment near the traces with arrows to indicate the points of adjustment.

6.7.6 Disposition. Forward telepsychrometer records completed during the month to NWRC not later than the second working day of the following month.

6.8 Hygrothermometer and Equivalent Systems.

* 6.8.1 Operating Range. The operating range of the sensors is normally the same as the graduated range of the dial indicators or the recorder chart. The normal operating ranges are:

a. Dry-bulb

(1) (WB) -50°F to +120°F

(2) (AF) -80°F to +130°F

(3) (N) -30°F to +130°F

b. Dewpoint

(1) (WB) -20°F to +80°F or -40°F to +80°F

(2) (AF) -50°F to +90°F

(3) (N) -30°F to +120°F

(4) (WB, N) The dewpoint should not be determined from these instruments when the relative humidity is less than 15 percent.

6.8.2 (WB, FAA) Comparison Data from Hygrothermometers. Upon installation of a hygrothermometer, comparative data between maximum and minimum 6-hourly synoptic extremes at the shelter site and the hygrothermometer site will be obtained for a period of 1 year. This action is not required if the shelter site is changed or a shelter is removed or unavailable on the date of the hygrothermometer installation.

6.8.2.1 Comparison Routine. Make comparisons as follows:

a. Read the hygrothermometer indices first and before resetting determine that the indicated extremes are compatible with the hourly temperatures entered on the observational form for the 6-hourly period involved.

b. Reset the maximum and minimum hygrothermometer indices. As soon as possible, read the shelter-mounted maximum and minimum thermometers.

c. Before resetting the shelter extreme thermometers, compare their readings with the corresponding hygrothermometer extremes.

d. If the shelter readings differ by more than three degrees from the corresponding readings of the hygrothermometer, recheck the readings of the shelter extreme thermometers.

e. Record temperature extremes from the shelter thermometers in block 90 of MF1-10, using the following example as a guide.

	Comparison Temps	
	Max	Min
MID TO 0050	62	60
0050	82	60
0648	60	54
1254	68	56
1848	80	66
MID	66	62
DAY	80	54

6.8.3 (WB, FAA) Resetting Hygrothermometer Indices. After each observation of maximum and minimum temperatures reset the "max" and "min" indices (pointers) in the following sequence:

a. Turn the LARGE reset knob slowly counterclockwise until max temperature index is adjacent to, or coincides with (according to design), the current-temperature pointer.

b. Turn the SMALL reset knob slowly clockwise until the min temperature index is adjacent to the current-temperature pointer.

c. Check to determine that adjustment of the min temperature index did not move the max temperature index.

6.8.4 (WB, FAA, N) Performance Documentation. Record the time and date of changes in instruments and exposure sites and the reason for such changes, in "Remarks, Notes, and Miscellaneous Phenomena" block of MF1-10. Similarly report the time, date and amount of changes in calibration of the hygrothermometer of more than +1°F, in dry-bulb or dewpoint.

6.8.5 (WB, FAA, N) Quality Control. The measures described here relate to the making of calibration checks and such preventive and corrective

maintenance as is not restricted to electronics technicians. In general, such station maintenance includes:

a. Cleaning and replenishing lithium chloride salt solution on the Dewcel

b. (WB) Use of test coils

c. (WB) Changing of tub s

d. (WB) Changing of plug-in type capacitors.

6.8.6 (WB, FAA, N) Calibration Checks. Normal calibration checks consist of comparing the hygrothermometer dry-bulb and dewpoint values with simultaneous values from a properly exposed comparison standard instrument (sling psychrometer or ventilated shelter-mounted psychrometer).

a. Exposure of Comparison Standard. The comparison values may be observed at a site convenient to the office, as long as there is no evidence that temperatures from such a site are nonrepresentative, as for example, in case departures exceed specified limits frequently and the reasons cannot be attributed to malfunctioning of the telepsychrometer system.

b. (WB) Test coils should be used in evaluating system performance, in accordance with the maintenance manual, to check indicator and cable performance.

6.8.6.1 (WB, FAA, N) Frequency of Checks. Calibration checks should be made:

a. Following maintenance (preventive as well as corrective maintenance).

b. At least once a week, as near 1200 LST on Monday as practicable, and more frequently when calibration is suspect or previous comparisons suggest the possibility of unstable or otherwise unsatisfactory performance. The frequency should be such as to keep performance within the following limits, as far as practicable:

(1) 2°F. for individual comparisons made with the comparison standard at a site remote from the hygrothermometer sensors. If this limit is exceeded, make a comparison promptly at the site of the hygrothermometer sensors, see (2) below. If the average of these comparison departures for the past three months exceeds 1°F., the frequency of comparisons should be doubled, at least, and approximately concurrent checks should be made at the hygrothermometer site until it is determined whether the difference is owing to the hygrothermometer or to

an average temperature difference between the observing sites. If a persistent temperature difference is noted, it may be applied as a correction to subsequent checks, as long as it remains valid.

(2) 1°F. for individual comparisons made with the comparison standard at the hygrothermometer site. If this limit is exceeded discontinue use of the portion of the system concerned until the trouble has been corrected. If periods of questionable performance (from time of an unsatisfactory check at the hygrothermometer site to the time of the preceding check, either (1) or (2) should begin to exceed 5 percent of total operating time for a period approximately 25 times the average period between checks (e.g., 6 months where checks are at weekly intervals), the frequency of comparisons should be doubled, at least, until stable operation is obtained.

(3) If the trend of the comparisons for the past 3 weeks show a relatively steady drift toward higher or lower values of dry-bulb or dewpoint, such as from deterioration of Dewcel coating, and the range of the change equals or exceeds 1°F., the frequency of comparisons should be increased, even though the limits in (1) or (2) have not been exceeded.

(4) A graph of comparison departures, or equivalent, is considered necessary as an aid in evaluating system performance and in determining the frequency of comparisons. WB Form 500-11, 450-4, or other convenient graph paper may be used. By plotting plus or minus departures above and below a horizontal zero reference line respectively, circumstances calling for corrective action or increased frequency or comparisons should be readily apparent; circumstances such as an increase in absolute departures, in the frequency of excessive departures, or a tendency for departures to be consistently but unnecessarily plus or minus, or undesirably variable. At a frequency of one to two comparisons a week, a year's record can easily be maintained on a single sheet 8 x 10 1/2" graph paper. If weekly comparisons are not made at the hygrothermometer site and comparison values suggest the possibility of a significant difference in temperature between the two exposure sites, a separate record should be made of comparison checks, made with the comparison standard exposed at the hygrothermometer site at random times of the night and day until the source of the difference has been determined.

(5) Clean and recoat the Dewcel with lithium chloride solution, in the manner described in the maintenance manual, each quarter and more frequently if necessary, in order to assure

satisfactory operation. Note in particular the special precautions in the maintenance manual for removing and reinstalling the Dewcel (see separate maintenance instructions).

6.9 Psychrometric Calculator. Use the scale based on the barometric pressure nearest the normal station pressure (e.g., sea-level stations will use 30-inch scale for all observations). At stations where the normal station pressure is unknown, the appropriate scale should be based on the elevation of the station, using table A12-2 as a guide in selecting a satisfactory scale.

Table A12-2. Selection of Psychrometric Calculator on Basis of Station Elevation

Station Elevation (Feet)	Computer Pressure Base (Inches of Mercury)
-531 to +392	30
+393 to +1341	29
1342 to 2316	28
2317 to 3836	27
3837 to 5976	25
above 5976	23

Based on ICAO Standard Atmosphere

6.9.1 Obtaining Psychrometric Data. The method of obtaining temperature, dewpoint, and relative humidity values with a psychrometric calculator varies with operating conditions. At wet-bulb temperatures near freezing, determine visually that the standby wet-bulb is unfrozen before using wet-bulb depression data.

6.9.2 Using the Calculator. Instructions for use of the calculator are printed on it. Note that different temperature scales of the calculator will be used according as the wet-bulb is covered with ice or water at the time of the observation. When the wet-bulb temperature is 32° or more, use the high temperature range of the calculator; when the wet-bulb temperature is less than 32°, use the low temperature range. Since it is the observer's responsibility to try to induce a frozen state when the wet-bulb is below 32°, in the relatively unusual event that he is unable to induce freezing, instructions on the low temperature range relating to a wet wick on the wet bulb (water unfrozen) should be followed.

CONTENTS

CHAPTER A13. MARINE OBSERVATIONS

FIGURES

TABLES

3. Marine Observing Procedures.

3.1 Wind.

3.1.1 True wind will be evaluated as in chapter A10. When the ship is moving, the wind experienced on the ship and ship's anemometer is the apparent wind, a combination of the wind vector and the ship's vector. Apparent wind must be converted to true wind.

3.1.2 Apparent Wind Observing Methods.

3.1.2.1 Obtain apparent wind from the ship's anemometer when available and in the opinion of the observer, adequately exposed. Otherwise, estimate the apparent wind direction to the nearest 10 degrees measured clockwise off the bow and the apparent wind speed by noting the effect or "feel" of the wind and referring to table A13-1.

Table A13-1. Apparent Wind Speed

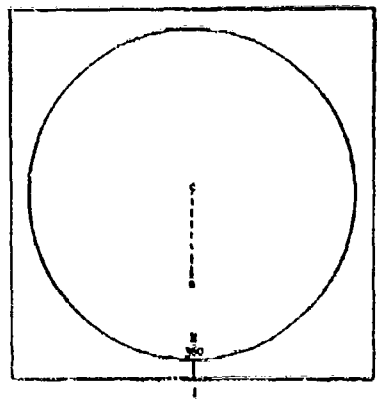
Speed (knots)	Indication
Less than 1--	Calm; smoke rises vertically
1-3---------	Smoke drifts from funnel
4-6---------	Wind felt on face
7-10--------	Wind extends light flag
11-16-------	Wind raises dust and loose paper on deck.
17-21-------	Wind waves and snaps flag briskly
22-27-------	Whistling in rigging
28-33-------	Inconvenience felt walking against wind
34-40-------	Walking becomes difficult

3.1.2.2 Plotting Board Method. To compute true wind from apparent wind relative to the ship's bow, adjust a rotary protractor such as the winds aloft plotting board or a shipboard plotter so that 0° coincides with the index line at the bottom edge of the protractor which is near the observer. Using any suitable scale, plot a point "a" at a distance from the center representing the ship's speed. Turn the protractor to the apparent wind direction relative to the ship's bow on the index. Using the same scale, plot a point "b" representing the apparent wind speed. Measure the distance between points "a" and "b." This distance on the scale used for "a" or "b" is the true wind speed. Rotate the protractor until point "a" is vertically above point "b" on a line parallel to the index line. When the two points are thus aligned, the protractor index indicates the wind direction relative to the ship's bow. After computing true heading from magnetic heading then add the ship's true heading to this value to obtain the true wind direction with respect to true north. An example is shown in figure A13-1.

Given: 1. Ship's speed 20 knots.
2. Apparent wind relative to bow of ship, 300° at 15 knots.
3. Ship's heading 160°.

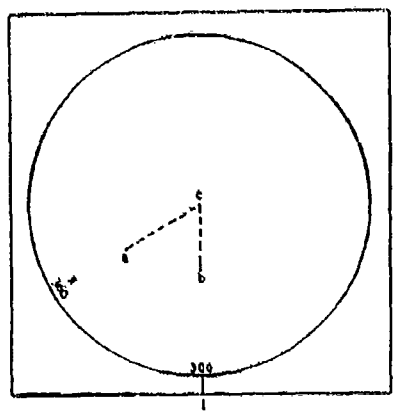
Computation:

Step 1. Rotate the protractor until 360° is at bottom of protractor on index line "ci." Using any convenient scale, locate and identify point "a" on line "ci" 20 units distant from center of protractor "c" and toward point "i." The distance "ac" now represents the ship's speed of 20 knots.



Step 2. Rotate the protractor until the apparent wind direction, i. e., 300°, coincides with index line "ci." Using the same scale as in step 1, plot "b" along the index line 15 units distant from "c" and toward "i." This distance "bc" represents the apparent wind speed.

Step 3. Using the same scale as in step 1, obtain the *true wind speed* by measuring the distance from "a" to "b."



Step 4. Turn the protractor until the line determined by points "a" and "b" is parallel to the vertical parallel lines on the plotting board (beneath the protractor), and until point "a" is above point "b." Read the computed wind direction relative to the bow, i. e., 226°, from the edge of the protractor closest to the observer on line "ci."

Step 5. Add the ship's heading, i. e., 160°, to the direction obtained in step 4, i. e., 160+226=386. Since this sum is greater than 360, subtract 360 to obtain the true wind direction, i. e., 386 minus 360=26°, which is the *true wind direction.*

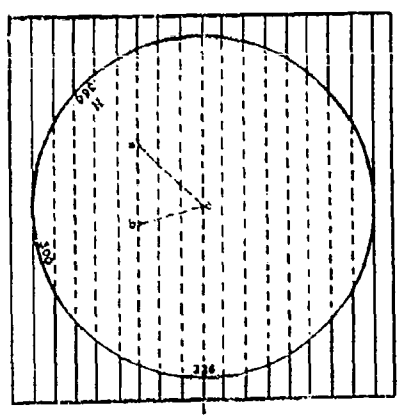


Figure A13-1. Computation of True Wind

3.1.2.3 Table A13-2 describes true wind effects on the sea. Values obtained by the plotting board method may be compared to this table as a check. When values do not agree with this table, refer to the conditions stated in ¶3.1.3.1 to determine the applicability of the table values. The following guidelines may also be used as a check:

a. The true wind direction is always on the same side of the ship as the apparent wind direction, but farther from the bow.

Table A13-2. True Wind Speed From Sea Condition

Knots	Sea Conditions	Probable wave height in feet
0-1	Sea smooth and mirrorlike	------
1-3	Scalelike ripples without foam crests	1/4
4-6	Small, short wavelets; crests have a glassy appearance and do not break	1/2
7-10	Large wavelets; some crests begin to break; foam of glassy appearance. Occasional white foam crests	2
11-16	Small waves, becoming longer; fairly frequent white foam crests	4
17-21	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray	6
22-27	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray	10
28-33	Sea heaps up and white foam from breaking waves begin to be blown in streaks along the direction of the wind; spindrift begins	14
34-40	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind	18
41-47	High waves; dense streaks of foam along the direction of the wind; crests of waves begin to topple, tumble, and roll over; spray may reduce visibility	23
48-55	Very high waves with long overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole, the surface of the sea is white in appearance. The tumbling of the sea becomes heavy and shocklike. Visibility is reduced	29
56-63	Exceptionally high waves that may obscure small and medium-sized ships. The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility reduced	37
64 and over	The air is filled with foam and spray. Sea completely white with driving spray; visibility very much reduced	45

b. When the apparent wind direction is aft of the beam, the true speed is greater than the apparent speed.

c. When the apparent wind direction is ahead of the beam, the true speed is less than the apparent speed.

3.1.3 True Wind Observing Method. True wind direction may be observed by noting the direction from which ripples, small waves and sea spray are coming. The direction is most easily found by sighting along the wave crests and turning 90° to face the advancing waves. The observer is then facing the true wind direction. Evaluate true wind direction to the nearest 10°.

3.1.3.1 The true wind speed may be estimated by noting the sea condition and referring to table A13-2. This table is based upon several assumptions which should be considered in arriving at an estimated wind speed. These assumptions are:

a. That the wind has been blowing at a constant speed and direction long enough to raise the appropriate sea. This may be from a few hours up to several days.

b. That the location is well removed from any land.

3.1.3.2 Some factors which will cause the speed given by the Table A13-2 to be too low are:

a. Winds which have just sprung up or freshened.

b. Off-shore winds within sight of land

c. Moderate or heavy precipitation, by smoothing the sea surface.

3.1.3.3 Some factors which will cause the speed given by the table to be too high are:

a. Waves running into shallow water

b. A decreasing wind speed.

3.1.3.4 The observer should use his own judgment in accepting or modifying the wind speeds given in table A13-2.

3.2 Sky Condition, Aviation and Synoptic. Sky condition for aviation observations is evaluated in accordance with the instructions in chapter A5.

3.2.1 Sky condition for synoptic purposes is evaluated in accordance with chapter A5 except when a partial obscuration exists. When the sky is partially obscured by surface-based phenomena, the sky cover value for N and

N_h is the ratio of cloud cover to the amount of sky visible, and the amount of sky obscured is not added to this value. For example, if 0.4 of the celestial dome is obscured by surface-based phenomena and clouds cover 1/4 of the visible sky, the sky cover for synoptic purposes is 2/8. The observer should assume that the entire celestial dome is in the same condition as the portion visible through the obscuration.

3.3 Visibility. Visibility at sea is evaluated in nautical miles, using the same reportable values specified for statute miles in chapter A6.

3.3.1 Visibility is determined by using the horizon, ships in company, radar, and stadiameter ranges. Estimates will be based upon the apparent size of the ship (or other object), and the portion visible. Use table A13-3 as a guide in determining distances (e.g., in accordance with line 7 of table A13-3, the horizon when viewed from a bridge 40 feet above the sea is 7.6 nautical miles away).

Table A13-3. Distance to Objects on the Horizon at Sea (Nautical Miles)

Height of observer's eyes above sea level (feet)	Height of object above sea level (feet)														
	0 [1]	10	20	30	40	60	80	100	150	200	300	400	600	800	1,000
10	3.8	7.2	8.7	9.9	10.8	12.5	13.9	15.1	17.7	19.8	23.5	26.5	31.6	36.0	39.8
15	4.9	8.0	9.5	10.7	11.6	13.3	14.7	15.9	18.5	20.6	24.3	27.3	32.4	36.8	40.6
20	5.4	8.7	10.2	11.4	12.3	14.0	15.4	16.6	19.2	21.3	25.0	28.0	33.1	37.5	41.3
25	6.0	9.3	10.8	12.0	12.9	14.6	16.0	17.2	19.8	21.9	25.6	28.6	33.7	38.1	41.9
30	6.6	9.9	11.4	12.6	13.5	15.2	16.6	17.8	20.4	22.5	26.2	29.2	34.3	38.7	42.5
35	7.1	10.4	11.9	13.1	14.0	15.7	17.1	18.3	20.9	23.0	26.7	29.7	34.8	39.2	43.0
40	7.6	10.8	12.3	13.5	14.4	16.1	17.5	18.7	21.3	23.4	27.1	30.1	35.2	39.6	43.4
45	8.0	11.3	12.8	14.0	14.9	16.6	18.0	19.2	21.8	23.9	27.6	30.6	35.7	40.1	43.9
50	8.5	11.7	13.2	14.4	15.3	17.0	18.4	19.6	22.2	24.3	28.0	31.0	36.1	40.5	44.3
60	9.3	12.5	14.0	15.2	16.1	17.8	19.2	20.4	23.0	25.1	28.8	31.8	36.9	41.3	45.1
70	10.0	13.2	14.7	15.9	16.8	18.5	19.9	21.1	23.7	25.8	29.5	32.5	37.6	42.0	45.8
80	10.7	13.9	15.4	16.6	17.5	19.2	20.6	21.8	24.4	26.5	30.2	33.2	38.3	42.7	46.5
90	11.4	14.5	16.0	17.2	18.1	19.8	21.2	22.4	25.0	27.1	30.8	33.8	38.9	43.3	47.1
100	12.0	15.1	16.6	17.8	18.7	20.4	21.8	23.0	25.6	27.7	31.4	34.4	39.5	43.9	47.7

[1] Horizon.

3.4 Atmospheric Phenomena. The observing instructions in chapter A7 apply for atmospheric phenomena.

3.5 Pressure. Atmospheric pressure is evaluated as specified in chapter A8 except as follows.

3.5.1 The aneroid barometer is used to determine station pressure in all observations.

3.5.2 The barograph pen is touched lightly each day at noon GMT and the barograph reading is compared to the aneroid barometer reading. The corrections thus established for the barograph are entered on the barogram

Table A3-13.

Amount of Barometric Change in the Last 3 Hours

Amount of rise or fall

pp						ppp					
Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars
00	0.000	0.0				100	0.295	10.0			
02	0.005	0.2	52	0.155	5.2	102	.300	10.2			
03	0.010	0.3	54	0.160	5.4						
05	0.015	0.5	56	0.165	5.6	103	.305	10.3	154	0.455	15.4
07	0.020	0.7	58	0.170	5.8	105	.310	10.5	156	.460	15.6
08	0.025	0.8	59	0.175	5.9	107	.315	10.7	157	.465	15.7
						108	.320	10.8	159	.470	15.9
10	0.030	1.0	61	0.180	6.1	110	.325	11.0	161	.475	16.1
12	0.035	1.2	63	0.185	6.3						
14	0.040	1.4	64	0.190	6.4	112	.330	11.2	163	.480	16.3
15	0.045	1.5	66	0.195	6.6	113	.335	11.3	164	.485	16.4
17	0.050	1.7	68	0.200	6.8	115	.340	11.5	166	.490	16.6
						117	.345	11.7	168	.495	16.8
19	0.055	1.9	69	0.205	6.9	119	.350	11.9	169	.500	16.9
20	0.060	2.0	71	0.210	7.1						
22	0.065	2.2	73	0.215	7.3	120	.355	12.0	171	.505	17.1
24	0.070	2.4	75	0.220	7.5	122	.360	12.2	173	.510	17.3
25	0.075	2.5	76	0.225	7.6	124	.365	12.4	174	.515	17.4
						125	.370	12.5	176	.520	17.6
27	0.080	2.7	78	0.230	7.8	127	.375	12.7	178	.525	17.8
29	0.085	2.9	80	0.235	8.0						
30	0.090	3.0	81	0.240	8.1	129	.380	12.9	179	.530	17.9
32	0.095	3.2	83	0.245	8.3	130	.385	13.0	181	.535	18.1
34	0.100	3.4	85	0.250	8.5	132	.390	13.2	183	.540	18.3
						134	.395	13.4	185	.545	18.5
36	0.105	3.6	86	0.255	8.6	135	.400	13.5	186	.550	18.6
37	0.110	3.7	88	0.260	8.8						
39	0.115	3.9	90	0.265	9.0	137	.405	13.7	188	.555	18.8
41	0.120	4.1	91	0.270	9.1	139	.410	13.9	190	.560	19.0
42	0.125	4.2	93	0.275	9.3	141	.415	14.1	191	.565	19.1
						142	.420	14.2	193	.570	19.3
44	0.130	4.4	95	0.280	9.5	144	.425	14.4	195	.575	19.5
46	0.135	4.6	97	0.285	9.7						
47	0.140	4.7	98	0.290	9.8	146	.430	14.6	196	.580	19.6
49	0.145	4.9		0.295	10.0	147	.435	14.7	198	.585	19.8
51	0.150	5.1	99	0.300	10.2	149	.440	14.9	200	.590	20.0
				etc.	etc.	151	.445	15.1	01	.595	20.1
						152	.450	15.2	203	.600	20.3

synoptic code on Service C will not include 6-hourly coded groups in their aviation observations unless specifically requested to do so. These groups are separated from all other groups by a slant and space. The individual groups are as follows:

a. BAROMETRIC TRACE, 3-HOUR PRESSURE CHANGE, AND PRECIPITATION AMOUNT (appRR).

(1) app. At stations equipped with a barograph for the 3-hour period prior to the actual time of the observation, encode as "a", Characteristic of Barometric Trace, the most appropriate code figure from table A3-12 and as "pp" the code figure for the pressure change in the past 3 hours as given in table A3-13. If the pressure change exceeds 9.8 millibars, encode pp as 99 and include the 99ppp group in the report. In such cases encode as ppp the change in millibars, using the tens, units and tenths digits, e.g., 23.4 millibars, would be encoded a99RR 99234.

(2) RR. Enter as "RR" the tenths and hundredths digits of the precipitation amount, water equivalent, in the past 6 hours. Encode a trace as 00. Omit RR when no precipitation has occurred. When the amount of precipitation is one inch or greater, enter the tenths and hundredths digits as RR and following the appRR group (or 99ppp group if one is reported) enter the whole inches in plain language, e.g., 3.01 inches would be encoded as app01 THREE.

* b. (WB,AF,N) CLOUD CODE GROUP ($1C_LC_MC_H$). Select the appropriate code figures for C_L, C_M and C_H from tables A3-14A, B, and C. When the middle or high clouds are unobservable because of lower clouds and/or obscuring phenomena a slant is entered for C_M, C_H, or both as appropriate. Omit this group when no clouds are present or clouds are completely hidden by obscuring phenomena on the surface or aloft.

* c. (WB) WATER EQUIVALENT OF DEPTH OF SNOW ON GROUND ($902s_ps_p$). Include this group each day in the 1800 GMT observation if the average snow depth is 2 inches or more. Encode as s_ps_p the inches and tenths of water equivalent as observed, e.g., 1.3 inches is encoded as 90213, 1.0 inch is 90210, 9.9 inches is 90299. Encode only the tenths figure of amounts over 9.9 inches and include the 903 group in the report.

Table A3-14A. Coding of C_L Clouds		
Priority	C_L Cloud Present	Code Figure
1	CB present with at least one top clearly fibrous or striated (cirriform).	9
2	CB present with the tops neither clearly fibrous, striated or in the form of an anvil.	3
3	SC formed by spreading and flattening of CU; other SC or CU may be present but no CB.	4
4	CU and SC, bases at different levels; SC is not formed by spreading or flattening of CU.	8
5	CU of moderate or strong vertical extent; other CU and SC may be present; all bases at same level.	2
6	Predominant type of low cloud is CU with little vertical extent and seemingly flattened, or ragged CU other than of bad weather, or both.	1
7	Predominant type of low cloud is SC not resulting from spreading or flattening of CU.	5
8	Predominant type is ST in a relatively continuous layer, in ragged shreds, or both.	6
9	Predominant type of low cloud is STFRA of bad weather or CUFRA of bad weather, or both (pannus) usually below AS or NS.	7

Table A3-14B. Coding of C_M Clouds

Priority	C_M Cloud Present	Code Figure
1	Sky is chaotic; AC generally at several levels.	9
2	AC with sproutings in the form of turrets or battlements or AC having the appearance of small cumuliform tufts.	8
3	AC with AS or NS present.	7
4	AC formed by spreading out and flattening of CU or CB is the only C_M cloud present.	6
5	Semi-transparent AC in bands, or AC in one or more fairly continuous layers (semi-transparent or opaque), progressively invading the sky. No AS or NS present.	5
6	AC is continually changing in appearance. No AS or NS present.	4
7	AC at two or more levels; not progressively invading the sky; no AS or NS is present.	7
8	AC at one level; not invading sky; greater part of AC is opaque. No AS or NS is present.	7
9	AC at one level; not invading sky; greater part of AC is semi-transparent; no AS or NS present.	3
10	NS or AS; greater part is sufficiently opaque to hide sun or moon. No AC is present.	2
11	AS, predominantly semi-transparent; sun or moon may be weakly visible through semi-transparent portions. No AC is present.	1

Table A3-14C. Coding of C_H Clouds		
Priority	C_H Cloud Present	Code Figure
1	CC is predominant high cloud present.	9
2	CS covers entire sky.	7
3	CS not covering the entire sky and not increasing.	8
4	CS and CI progressively invading the sky, generally growing denser; continuous veil extends beyond 45° above the horizon. CI often in polar bands converging towards horizon.	6
5	CS and CI progressively invading the sky and generally growing denser; continuous veil does not reach 45° above horizon. CI often in polar bands converging towards horizon.	5
6	CI (hooks or filaments) progressively invading the sky and generally growing denser.	4
7	Dense CI, often in the form of an anvil, being the remains of upper parts of CB.	3
8	Predominant high cloud present is a combination of dense CI, CI with sproutings (like turrets or battlements) and of CI in tufts.	2
9	Predominant high cloud is CI in form of filaments, strands or hooks.	1

* d. (WB) WATER EQUIVALENT OF DEPTH OF SNOW ON GROUND ($903s_Ps_P$). This group is used along with the 902 group to report amounts greater than 9.9 inches. Enter as s_Ps_P the whole inches of water equivalent. For example 12.4 inches is entered as 90204 90312.

e. DEPTH OF SNOW ON GROUND (904spsp). This group is included in the 1200 GMT observation whenever there is more than a trace of snow on the ground. It is included in the 0000, 0600 and 1800 GMT observations if there is more than a trace of snow on the ground and more than a trace of precipitation (water equivalent) has occurred within the past 6 hours. Encode as s_Ps_P the tens and units digits of the snow depth. Include a group 90499 for each 100 inches of snow. For example, 3 inches is encoded as 90403; 100 inches encoded 90499 90400; 99 inches encoded 90499; 219 inches encoded as 90499 90499 90419.

* f. MAXIMUM OR MINIMUM TEMPERATURE $T_{n/x}T_{n/x}$. For the symbols $T_{n/x}T_{n/x}$ encode maximum or minimum temperature in degrees Fahrenheit as follows:

(1) At 0000 GMT - maximum for past 12 hours
(2) At 0600 GMT - maximum for past 24 hours
(3) At 1200 GMT - minimum for past 12 hours
(4) At 1800 GMT - minimum for past 24 hours
(5) Encode positive values by using the tens and units digits.

Negative values are encoded by algebraically adding the negative value to 100 and encoding the tens and units digits of the sum as $T_{n/x}T_{n/x}$. Omit this group when the $4T_xT_xT_nT_n$ group is included in the report.

EXAMPLES

Temperature Extreme	$T_{n/x}T_{n/x}$
-15	85
-5	95
0	00
5	05
25	25
105	05

g. 24-HOUR PRECIPITATION $2R_{24}R_{24}R_{24}R_{24}$. If more than a trace of precipitation, water equivalent, has occurred in the past 24 hours, this group is included in the report at 1200 GMT (or other individually designated time). If the station is opened between 1200 and 1400 GMT, this group is transmitted in any collection or scan period before 1400 GMT. Encode the tens, units, tenths and hun-

dredths of inches, water equivalent, as $R_{24}R_{24}R_{24}R_{24}$. When more than a trace, water equivalent, has occurred in the preceding 24 hours, and the amount cannot be determined, report 2////.

EXAMPLES

24-HOUR AMOUNT	ENCODED	24-HOUR AMOUNT	ENCODED
T	Omitted	1.00	20100
.01	20001	10.00	21000
.10	20010	12.34	21234

h. (WB, N) TEMPERATURE EXTREMES ($4T_xT_xT_nT_n$). When reported, this group replaces the $T_n/_xT_n/_x$ group in the 1200 GMT (or other individually designated time) observation. At stations opening between 1200 and 1400 GMT, this group is transmitted in any collection or scan period before 1400 GMT. Encode for T_xT_x the maximum temperature for the previous day, midnight to midnight, LST, and for T_nT_n the minimum temperature for the previous 12 hours in whole degrees Fahrenheit using the tens and units digits only. Encode minus temperatures by algebraically adding the temperature to 100. Indicate missing data with a slant.

EXAMPLES

Maximum Temperature	Minimum Temperature	$4T_xT_xT_nT_n$
0°F	-15	40085
32°F	-1	43299
100°F	72	40072
Misg	45	4//45

* 2 13.10 Freezing Level Data. All rawinsonde stations that file hourly aviation observations will report freezing level and icing data in the remarks section of the earliest possible hourly aviation observation after this information is available. Icing data are reported only when icing is determined from variations in ascensional values of the balloon (see FMH#3).

a. Data in the following format should be appended to the aviation report:

RADAT UU(D) ($h_ph_ph_p$) ($h_ph_ph_p$)

($h_ph_ph_p$) (/n)

RAICG HHMSI SNW

b. The individual elements are encoded as follows:

(1) RADAT - a contraction to indicate that freezing level data follows.

(2) UU - Relative humidity to the nearest percent. Use highest RH of any of the coded crossing of the 0°C isotherm. Code 00 when the RH is 100%, 10 when the RH is 10% or less. Enter "ZERO" when the entire sounding is below 0°C. Code "MISG" when the surface temperature is warmer than 0°C and the sounding is terminated before the 0°C isotherm is reached. Code // when RH is missing.

(3) (D) - a letter designator identifying the 0°C isotherm crossing to which the coded value of UU corresponds; L for lowest, M for middle, H for highest. When only one height value is coded this figure is omitted.

(4) ($h_p h_p h_p$) - A height coded in hundreds of feet above MSL at which the sounding crosses the 0°C isotherm. Levels are coded as follows:

(a) The first crossing of the 0°C isotherm after release.

(b) The uppermost or two uppermost crossings of the 0°C isothe. m in ascending order of height.

(5) (/n) - Indicator group to show the number of crossing of the 0°C isotherm other than those whose heights are coded. If all crossings are coded /n group is omitted.

(6) (RAICG) - A contraction to indicate that icing data follows. (Only when icing is present)

(a) HH - The altitude of icing in hundreds of feet MSL as determined from the RAOB. Include the indicator "MSL" following the height, e.g., RAICG 12 MSL indicates "icing above 1200 feet mean sea level."

(b) SNW - Include the contraction SNW if snow is apparently causing a slow ascension rate, e.g., RAICG 13 MSL SNW.

Examples:

* RADAT 84M019045051/1

84 - Relative humidity at the middle coded height (045) of the 0°C isotherm crossing is 84%.

019 - Height at which sounding first crosses 0°C isotherm 1,900 feet MSL.

045 - Height of next to uppermost level at which sounding crosses 0°C isotherm 4,500 feet MSL

051 - Height of uppermost level at which sounding crosses 0°C isotherm 5,100 feet MSL

/1 - Indicator to show that one additional crossing of the 0°C isotherm occurred.

RADAT 87045

87 - Relative humidity at the lowest crossing of the 0°C isotherm

045 - Height of the lowest (only) crossing of the 0°C isotherm, 4,500 feet MSL.

RADAT 871 024036

87 - Relative humidity at the lowest crossing of the 0°C isotherm

024 - Height of the lowest crossing of the 0°C isotherm 2,400 feet MSL

036 - Height of the uppermost crossing of the 0°C isotherm, 3,600 feet MSL.

RADAT MISG

Sounding did not reach 0°C isotherm

RADAT ZERO

All portions of sounding 0°C or colder.

* 2.13.11 (AF, N) Runway Conditions. When runway surface conditions and runway condition readings are received from the Base Operations Officer, encode this information as follows:

a. RUNWAY SURFACE CONDITIONS

CONDITION REPORTED	ENCODED
Wet Runway	WR
Slush on Runway	SLR
Loose Snow on Runway	LSR
Packed Snow on Runway	PSR
Ice on Runway	IR

b. RUNWAY CONDITION READING. A two digit number between 02 and 26. It is entered as received following the runway surface condition.

c. REMARKS. Append "P" when conditions are patchy, and "SANDED" when applicable.

d. TIME. Append time (GMT) of determination as reported by base observations.

e. EXAMPLES. Packed snow on runway, decelerometer reading 15 - PSR15 2000
Patchy ice on runway, decelerometer reading 8 - IR08P 2115
Ice on runway, decelerometer reading 5, condition patchy, runway sanded - IR05P SANDED 0900.

* f. Longline Transmission. Transmit these remarks as a single element special or append them to an R, RS, or S observation if that observation is being prepared when the information is received. Once runway conditions have been given initial longline dissemination, include the remark in each subsequent record observation until the data are amended or cancelled by the Base Operations Officer. Do not disseminate this information locally as a part of any weather observation.

* g. (AF) Local Dissemination. Base Operations personnel are authorized to optionally disseminate runway conditions and runway condition readings over the local weather dissemination system. This optional dissemination is subject to the following USAF directed conditions:

(1) Base operations personnel are responsible for entering and updating the RSC/RCR data and retaining full responsibility for disseminating RSC/RCR values to those agencies not included on the base weather dissemination system.

(2) Base operations personnel are responsible for disseminating updating RSC/RCR data to all agencies when the weather dissemination system is inoperative or inadequate.

(3) Only RSC/RCR information pertaining to the active runway will be disseminated; taxiway and ramp data will not be disseminated.

(4) Weather information will have priority over dissemination of RSC/RCR data.

2.13.12 Weather Modification. Whenever agencies conducting dispersal activities advise that such efforts are about to take place, are taking place, have ended, or they indicate when such efforts may cease to affect the terminal weather, this information will be reported in aviation weather observations as a remark in column 13 using the following procedures:

a. A report of dispersal activities will be appended to the first record or special observation following receipt of information that such activities are scheduled or underway, except that the information received several hours in advance of scheduled or planned activities will be held and appended to an aviation weather report no more than two hours preceding the time the operation will begin. Abbreviations or contractions currently authorized for use in aviation reports, such as "DSPRL", "F", "ST" etc., will be used whenever appropriate.

b. Remarks on weather dispersal activities should include:

(1) Identification of the phenomenon to which the dispersal effort is directed, for example, "F DSPRL", "ST DSPRL", etc.

(2) The first report should include the time (GMT) the activity began or is expected to begin; for example "F DSPRL B0910", "ST DSPRL SKEDD B1300", "F DSPRL BUNKN" (when activity has started but actual time unknown).

(3) Activity already reported and continuing should be included in each subsequent record observation as "F DSPRL CONTG", etc.

(4) The concluding report for a weather dispersal operation should indicate the time (GMT) that an operation ceased or is scheduled to cease. This report may be appended to the record observation following notification that dispersal activity has stopped or to the record observation preceding the scheduled time for ending the activity. If the dispersal operator provides a sound, scientific estimate of the time the dispersal agent

may cease to influence terminal weather, this time may be reported in lieu of the time of ending or scheduled ending of dispersal operations. Some examples might be "F DSPRL E1620", "ST DSPRL SKEDD E1417", "ST DSPRL EFF SKEDD E1702", etc.

2.14 Column 14. This column is not used.

2.15 Observer's Initials (Column 15). Enter the initials of the observer taking the observation.

2.16 (WB, N) Time of Observation (Column 16). Enter the minutes of the actual time as entered in column 2.

2.17 Station Pressure (Column 17). Enter the station pressure to the nearest 0.005 inch of mercury.

2.17.1 (AF) Station Pressure (Column 17). Enter station pressure to the nearest 0.005 inch of mercury only on 3- and 6-hourly observations.

* 2.18 (WB,FAA,N) Dry-Bulb Temperature (Column 18). Enter the dry-bulb temperature in degrees and tenths Fahrenheit:

a. If psychrometric data is obtained from other than a hygrothermometer, or equivalent system, or

b. there is a local need for the datum.

* 2.19 (WB,FAA,N) Wet-Bulb Temperature (Column 19). Enter the wet-bulb temperature in degrees and tenths Fahrenheit:

a. If phychrometeric data is obtained from other than a hygrothermometer or equivalent system, or

b. there is a local need for the datum.

2.20 (WB, N) Relative Humidity (Column 20). The entry of relative humidity is an optional procedure. If it is needed, enter the relative humidity to the nearest percent.

* 2.21 Total Sky Cover (Column 21). Enter for each hourly observation the tenths of sky covered (not necessarily hidden) by all clouds and obscuring phenomena aloft, and of sky hidden by surface based obscuring phenomena, which are visible at the station. For example, enter 6 for six tenths, 0 for clear or less than one tenth, etc.

2.21.1 (WB) Estimated Data. At First-Order Weather Bureau Stations, where less than 24 record observations are taken a day, enter the total sky

cover observed between sunrise and sunset at the beginning of each hour that personnel are on duty and enter estimated values for daylight hours when personnel are not on duty.

2.22 (WB, N) Amount of Lowest Layer, (Column 22). Considering only the lowest layer of clouds or obscuring phenomena, enter the tenths of sky covered (not necessarily hidden) by the phenomena aloft or hidden by surface-based phenomena. Enter amounts to the nearest tenth. Make this entry only at the time of each three- or six-hourly observation.

2.23 (WB, N) Type of Lowest Layer (Column 23). Enter the contraction for the type of cloud or obscuring phenomena present in the lowest layer. Select the abbreviation from table A3-15 that represents the predominant type except that if Cb is present in any amount it will take preference. If two or more types are present in equal amounts (except Cb) enter the abbreviation for the one considered by the observer to be most significant.

2.23.1 (WB, N) Cloud Direction. Stations in WMO Region V, Southwest Pacific that code the $7RRD_LD_M$ synoptic code group, or others having a local requirement for entering cloud directions on MF1-10, enter direction from which layers aloft are moving to 8 compass points, using arrow symbols as shown in table A3-16; if direction is unknown, omit entries of direction.

2.24 (WB, N) Height of Lowest Layer (Column 24). Enter the height of the layer in hundreds of feet above field elevation in the increments shown in table A3-2. Enter the vertical visibility for surface-based obscuring phenomena using a "-" to represent unlimited vertical visibility. If the lowest layer is a ceiling, prefix the height with the ceiling designator used in column 3.

TABLE A3-16. CLOUD DIRECTION MOVEMENT

C	calm		
↓	from north	↑	from south
↙	from northeast	↗	from southwest
←	from east	→	from west
↖	from southeast	↘	from northwest

2.25 (WB, N) Amount of Second Layer (Column 25). Considering only the second layer of clouds or obscuring phenomena in ascending order, enter the tenths of sky covered by the phenomena aloft or hidden by a surface-based phenomena. Enter the amount to the nearest tenth. If the whole sky is hidden by the lowest layer enter a "U" unless the amount is reported by aircraft or radar. Make this entry only at the time of each 3- and 6-hourly observation.

Table A3-15. Cloud Types and Obscuring Phenomena

Cloud Types	Contractions
Altocumulus	AC
Altocumulus castellanus	ACCAS
Altocumulus (lenticular)	ACSL
Altostratus	AS
Cirrocumulus	CC
Cirrocumulus (lenticular)	CCSL
Cirrostratus	CS
Cirrus	CI
Cumulonimbus	CB
Cumulonimbus mamma (Mammatocumulus)	CBMAM
Cumulus	CU
Cumulus Fractus	CUFRA
Stratus Fractus	STFRA
Nimbostratus	NS
Stratocumulus	SC
Stratocumulus (lenticular)	SCSL
Stratus	ST
Obscuring Phenomena	
Precipitation	
Drizzle (any form and intensity including ZL)	L
Hail	A
Ice crystals	IC
Rain (any form and intensity including RW and ZR)	R
Ice pellets (any form and intensity including IPW)	IP
Snow (any form and intensity including SW, SP, and SG)	S
Hydrometeors other than precipitation	
Blowing snow	BS
Blowing spray	BY
Fog (any form including GF and IF)	F
Lithometeors	
Dust (including BD)	D
Haze	H
Sand (including BN)	N
Smoke	K

2.26 (WB, N) Type of Second Layer (Column 26). Enter the contraction for the type of cloud or obscuring phenomena present in the second layer if one exists and has either been observed from the station or reported by aircraft or radar when the lower layer hides all of the sky. Enter a "U" if a second layer is reported by aircraft or radar but the type is unknown. Select the contraction from table A3-15 that represents the predominant type of cloud in that layer except that if Cb is present in any amount it will take preference. If two or more clouds are present in equal amounts (except Cb) enter the abbreviation for the one considered by the observer to be most significant.

2.27 (WB, N) Height of Second Layer (Column 27). If a second layer of clouds is being reported, enter the height of the layer in hundreds of feet above the field elevation or the vertical visibility into a surface-based obscuring phenomena, using the increments listed in table A3-2. If this layer is a ceiling, prefix the height with the ceiling designator used in column 3.

2.27.1 If the second layer is being reported by aircraft or radar and is not visible from the surface because of a lower broken or overcast layer, prefix the height with an "A" for aircraft or "R" for radar as appropriate, or if the height of the layer is not reported, enter a "U".

2.28 (WB, N) Summation Total (Column 28). Enter the summation amount of the lowest two layers (if there are two) of clouds and/or obscuring phenomena to the nearest tenth except that the entry shall be omitted when the lowest layer is completely hiding the sky and no upper layers have been reported by either aircraft or radar. The maximum amount to be entered is 10.

2.29 (WB, N) Amount of Third Layer (Column 29). Considering only the third layer, make entries in accordance with ¶2.25.

2.30 (WB, N) Type of Third Layer (Column 30). Considering only the third layer, make entries in accordance with ¶2.26.

2.31 (WB, N) Height of Third Layer (Column 31). Considering only the third layer, make entries in accordance with ¶2.27.

2.32 (WB, N) Summation Total (Column 32). Considering the lowest three layers, make entries in accordance with ¶2.28.

2.33 (WB, N) Amount of Fourth Layer (Column 33). Considering only the fourth layer, make entries in accordance with ¶2.25.

2.34 (WB, N) Type of Fourth Layer (Column 34). Considering only the fourth layer, make entries in accordance with ¶2.26.

2.35 (WB, N) Height of Fourth Layer (Column 35). Considering only the fourth layer, make entries in accordance with ¶2.27.

2.36 (WB, FAA, N) Total Opaque Sky Cover (Column 36). Enter as a whole number the total tenths of sky that are hidden by clouds and/or obscuring phenomena. Note that this entry is similar to entry in column 21 except that sky cover through which the sky can be seen is disregarded. The maximum amount to be entered is 10.

2.37 (WB, N) Pressure Characteristic (Column 37). Enter for all 3- and 6-hourly observations a single figure corresponding to the pressure characteristic from table A3-12 as determined from and representing the barograph trace in the past three hours.

2.38 (WB, N) Net 3-Hour Pressure Change (Column 38). Enter for all 3- and 6-hourly observations, at stations having a microbarograph, the net change in the station pressure for the preceding three hours to the nearest 0.005 inch by subtracting corresponding entries in column 17. If an observation was not taken three hours earlier, determine the change from the barogram.

2.39 (WB) Sunshine (Column 39). Entries of hourly sunshine will be based on autographic records and on observed or estimated periods of sunshine during periods when the autographic record is incomplete. At stations not equipped with sunshine duration totalizers, enter minutes of sunshine during each hour, beginning with the hour of sunrise and ending with the hour of sunset. Include the observed (unrecorded) sunshine following a clear sunrise or preceding a clear sunset in the entry for the hour of sunrise.

2.40 (WB) Precipitation (Column 40). At first-order stations equipped with recording gages, enter corrected hourly amounts of precipitation in inches and hundredths for the period beginning with the hour printed in column 16. Consider the hour identified as "00" in column 16 as beginning at 0000 LST; the hour identified as "01" as beginning at 0100; etc. Additional entry instructions follow:

a. No precipitation during hour - omit entry

b. A trace, but less than 0.005 inch - enter T

c. Automatic record (if any) incomplete - enter estimated amount with the prefix E.

2.41 (WB, FAA, N) Time (Column 41). No entry is required.

2.42 Time (Column 42). Enter the beginning time of the first 6-hourly observation scheduled after 0000 LST in the block captioned "MID TO". In the following four blocks, enter the beginning time of each 6-hourly observation. In the time zones where midnight, LST, corresponds to the time of a 6-hourly observation, omit entries on the lines marked "MID TO" and "MID". Make all entries in four figures to the nearest minute (LST).

2.43 Observation Number (Column 43). No entry required.

* 2.44 Precipitation (Column 44). At stations taking midnight observations enter the amount of precipitation that has occurred between the midnight observation and the first 6-hourly observation time on the line captioned

"MID TO". At 6-hourly observation times enter on the lines captioned 1, 2, 3, and 4, the amount of precipitation occurring in the 6 hours prior to each of the 6-hourly observations in chronological order. When midnight observations are taken, enter the amount of precipitation that has occurred between the last 6-hourly observation and the midnight observation. Enter the amount to the nearest hundredth of an inch except that "0" is entered for no precipitation and a "T" is entered for amounts of less than 0.005 inch. If no precipitation has occurred to actual observation time but is observed to occur prior to coding of the observation, enter "T" even though a measurable amount may have occurred.

2.44.1 Estimated Data. Whenever the water equivalent of solid precipitation cannot be measured by melting or weighing of the sample or core sampling, enter the estimated water equivalent on the basis of the 1/10 ratio method, or other ratio where there is evidence that a different ratio is more appropriate for the individual storm or station. Prefix estimated values with the symbol "Ø" and enter the ratio used as a remark in block 90; e.g., "Ø" - 1/12 ratio used.

2.44.2 (AF) Locations Operating Less Than 24 Hours. At locations operating less than 24 hours per day, when one or more 6-hourly observations have not been recorded, determine the total accumulation of precipitation since the last recorded 6-hourly observation. Enter the amount on the line corresponding to the current 6-hourly observation. Prefix the entry with "#" and enter a remark in block 90 to indicate the actual time period applicable to the amount, e.g., #12 HOUR PCPN.

* 2.45. Snowfall (Column 45). At 6-hourly observation times the amount of snowfall in the six hours prior to the observation shall be entered on the lines captioned 1, 2, 3, and 4. At stations taking midnight observations, the snowfall between midnight and the first six-hourly and the last six-hourly and midnight will be entered in the blocks captioned "MID TO" and "MID" respectively. The entries are made as follows:

a. No 6-hour solid precipitation - Enter 0

b. A trace but less than 0.05 inch - Enter T, and if precipitation melted as it fell, enter "T-Melted as it fell" in block 90.

c. A measurable amount has occurred - Enter the maximum depth of solid precipitation accumulated in the period. If several occurrences of solid precipitation occur in the period, such as snow showers, and each fall melts either completely or in part before the next fall occurs, enter the total of the maximum depths accumulated by each of the falls.

d. Prefix estimated amounts with an E and in Block 90 enter E-Estimated due to melting.

e. Enter an asterisk as a prefix to the amount if it consists entirely of hail and in block 90 enter *Hail.

f. (AF) Use procedure in §2.44.2 when appropriate.

* 2.46 Snow Depth (Column 46). Enter the depth of solid precipitation and ice on the ground at the time of each 6-hourly observation in chronological order on the lines captioned 1, 2, 3, and 4 and at the time of the midnight observation if one is taken, on the line captioned "MID". Make the entries as follows:

a. No snow on ground in exposed areas (snow may be present in forested or otherwise protected areas) - Enter 0.

b. A trace but less than 0.5 inch on ground in representative areas - Enter T

c. A measurable amount is on the ground, enter the depth to the nearest whole inch.

d. Whenever solid precipitation has occurred in the past six hours and because of melting, the current depth is less than at some time during the past 6 hours (reportable values), enter the current depth with an asterisk, and enter the maximum depth, and the approximate time (LST) of occurrence in block 90, e.g., *MAX SNOW DEPTH 1 AT 1530E.

e. Enter an asterisk as a prefix to the depth if it consists entirely of hail and in Block 90 enter *Hail.

2.47 (WB, FAA, N) Maximum Temperature (Column 47). Enter the maximum temperature in whole degrees Fahrenheit that has occurred in the six hours prior to each 6-hourly observation and between midnight and the first 6-hourly observation and between the last 6-hourly observation and midnight on the lines captioned 1, 2, 3, and 4 and "MID TO" and "MID" respectively.

2.48 (WB, FAA, N) Minimum Temperature (Column 48). Enter the minimum temperature in whole degrees Fahrenheit that has occurred in the six hours prior to each 6-hourly observation and between midnight and the first 6-hourly observation and between the last 6-hourly observation and midnight on the lines captioned 1, 2, 3, and 4 and "MID TO" and "MID" respectively.

2.49 (WB, N) Local Use (Column 49).

2.50 (WB, N) State of Ground (Column 50). At First-Order Weather Bureau Stations and Navy Stations, enter the state of ground at the time of each 6-hourly observation by selecting the highest applicable code figure from table A3-17. Omit this entry at stations which do not have sites approximating the criteria in the table.

2.51 (WB, N) Sea State and Direction (Column 51). Enter state and direction of the sea as a code figure in accordance with table A3-18. Record direction from which the sea is coming as an arrow in accordance with table A3-19. Example: A rough sea (waves 8 - 13 feet) from the southwest would be recorded as "5↙".

2.52 (WB, N) Swell Height and Direction (Column 52). The term "swell" refers to the wave motion that underlies the "sea" raised and driven by the local wind. Swell usually has traveled over a considerable distance from the point where it was generated by the wind, and its direction and height may often differ widely from those of the local wind-driven waves (wind waves). Record height of swell as the estimated average height of swell in the open sea, measured in whole feet from crest to trough. Record direction from which the swell is coming to eight points of the compass as an arrow in accordance with table A3-19.

2.53 (WB, N) Swell Period (Column 53). Swell period is the average time between successive crests, measured to the nearest second. Determine swell period by watching the rise and fall in the swell of a patch of foam or other floating object, and enter in seconds in column 53. When the elapsed time, measured by a stopwatch, of ten successive rises of such an object has been obtained, a good average period may be recorded by taking one-tenth of the value.

2.54 (WB, N) Surf (Column 54). At stations with means of observing surf conditions enter surf data every 6 hours using the code $H_SH_SM_SP_SD_S$ where the symbols have the following meaning:

a. H_SH_S - Average height of waves in feet. Ninety-nine indicates average height impossible to estimate.

b. M_S - Difference between height of maximum and average wave in 5-minute intervals. Select the appropriate code figure from table A3-20.

c. P_S - Period of time between passage of successive breakers at a fixed point. Select the appropriate code figure from table A3-21.

d. D_S - Angle of breakers with beach and direction of wave travel (referred to observer on beach facing the sea). Select the appropriate code figure from table A3-22.

2.55 (WB, N) Water Temperature (Column 55). At land stations where water temperature is read, enter these values in degrees and tenths of degrees Fahrenheit.

Table A3-17. State of Ground

Code Figure	Description	Observations based on:
0	Surface of ground dry with no appreciable amount of dust or loose sand	Representative Area which approximates the following: (1) Convenient and permanent access (2) Not affected by paved areas (3) 100 yards in diameter (4) Elevation within 100 ft. of station elevation (5) Same general topographical structure and vegetation as surrounding area.
1	Surface of ground moist (e.g., dew)	
2	Surface of ground wet (puddles on surface)	
3	Surface of ground frozen to at least several inches	
4	Glaze or ice on ground but no snow or melting snow	Representative Cleared Ground which approximates the following: (1) Part of representative area (2) More than 50 square feet (3) Level (4) Soil typical of surrounding country (5) Preferably grass-covered (kept free of overgrowth, but surface layer of soil undisturbed)
5	Snow or melting snow covering less than one-half of ground	
6	Snow or melting snow covering more than one-half but not all of ground	
7	Snow or melting snow covering ground completely	
8	Loose dry snow, dust or sand covering more than one-half but not all of ground	
9	Loose dry snow, dust or sand covering ground completely	

* Table A3-18. State of Sea

Code Figure	Description of Sea	Mean maximum height of sea waves	
		Feet	Meters
0	Calm (glassy)	0	0
1	Calm (rippled)	0-1/3	0-0.1
2	Smooth (wavelets)	1/3-1 2/3	0.1-0.5
3	Slight	1 2/3-4	0.5-1.25
4	Moderate	4-8	1.25-2.5
5	Rough	8-13	2.5-4
6	Very rough	13-20	4-6
7	High	20-30	6-9
8	Very high	30-45	9-14
9	Phenomenal	over 45	over 14

Table A3-19. Direction of Sea

Figure	Direction	Figure	Direction
C	Calm	↓	From south
↓	From north	↙	From southwest
↙	From northeast	←	From west
←	From east	↖	From northwest
↖	From southeast		

Table A3-20. Surf (M_s)			
Code Figure	Difference between max and average wave heights	Code Figure	Difference between max and average wave heights
0	0	8	8 feet
1	1 foot	9	Greater than 8 feet except when HH is reported as 99 in which case, "9" means an estimated difference is impossible to determine.
2	2 feet		
3	3 feet		
4	4 feet		
5	5 feet		
6	6 feet		
7	7 feet		

Table A3-21. Surf (P_s)			
Code Figure	Period	Code Figure	Period
0	No surf	5	11 or 12 seconds
1	Less than 5 seconds	6	13 to 15 seconds
2	5 or 6 seconds	7	16 to 18 seconds
3	7 or 8 seconds	8	Greater than 18 seconds
4	9 or 10 seconds	9	Impossible to estimate

Table A3-22. Surf (D_s)			
Code Figure	Angle of breakers with beach	Code Figure	Angle of breakers with beach
0	Calm	5	0° - 10°
1	0° - 10°	6	10° - 20° from right
2	10° - 20° from left	7	More than 20°
3	More than 20°	8	Confused but predominately from the right
4	Confused but predominately from the left	9	Unknown

2.56 (WB) Soil Temperature (Column 56). At designated stations record the soil temperature in degrees and tenths of degrees Fahrenheit.

2.57 (WB, N) Local Use (Column 57). This column is reserved for local use. When using it identify the entries by labeling the column heading.

2.58 (WB, N) Local Use (Column 58).

2.59 Time (Column 59). At the time of each 6-hourly observation, enter the time the barometer is read, or if an altimeter setting indicator is used for obtaining station pressure, the time it was read.

2.59.1 (AF) Entries in Columns 59 through 65. Make entries in columns 59 through 65 only if the barograph is used routinely for station pressure.

2.60 Attached Thermometer (Column 60). When a mercury barometer is used for the computation of station pressure, enter the temperature taken from the attached thermometer to the nearest 0.5 degrees Fahrenheit.

2.61 Observed Barometer (Column 61). When a mercury barometer is used for the computation of station pressure, enter the reading to the nearest thousandth of an inch. If an aneroid barometer is used, enter the reading to the nearest five thousandth of an inch or tenth of a millibar. Omit the entry if reading is obtained from an Altimeter Setting Indicator.

2.62 Total Correction (Column 62). Where mercury barometers are used to compute station pressure, enter the value obtained from the Total Correction Table or by algebraic addition of the sum of corrections given on the Barometer Correction Card and the temperature correction, to the nearest thousandth of an inch. If a precision aneroid barometer is used, make entry to the nearest five thousandth of an inch or tenth of a millibar.

2.63 Station Pressure (Column 63). If entries have been made in columns 61 and 62, the entry in this column is the algebraic sum of columns 61 and 62. Otherwise if an altimeter setting indicator is used to determine station pressure, enter the corrected reading to the nearest five thousandth of an inch or tenth of a millibar.

2.64 Barograph (Column 64). Enter the observed barograph reading to the nearest five thousandth of an inch or tenth of a millibar.

2.65 Barograph Correction (Column 65). Subtract column 64 from column 63 and enter the difference to the nearest five thousandth of an inch or tenth of a millibar with the proper sign in column 65. If column 64 is higher than column 63, the correction entered in column 65 will be preceded by a minus sign. If this difference is greater than five hundredths of an inch or one and one-half millibars, precede the entry with an asterisk, and reset the barograph to zero correction. Make a note in block 90 explaining the asterisk, e.g., barograph reset to zero correction at 1458LST.

2.66 (WB, FAA, N) 24-Hour Maximum Temperature (Column 66). Enter the maximum temperature recorded in column 47 for the day to the nearest whole degree Fahrenheit, disregarding the entry in column 47 on the line captioned "1" if midnight observations are taken. Enter "M" if data are missing. This entry may be omitted at second-order stations if the information can be derived from entries in column 47.

2.67 (WB, FAA, N) 24-Hour Minimum Temperature (Column 67). Enter the minimum temperature recorded in column 48 for the day to the nearest whole degree Fahrenheit, disregarding the entry in column 48 on the line captioned "1" if midnight observations are taken. Enter "M" if data are missing. This entry may be omitted at second-order stations if the information can be derived from entries in column 48.

2.68 24-Hour Precipitation Water Equivalent (Column 68). Enter the total precipitation for the 24 hours ending at midnight as follows:

a. No precipitation - Enter 0.

b. A trace, but less than 0.005 - Enter T. A trace includes the sum of any number of T observations unless a recording or totalizing gage indicates 0.005 inch or more.

c. A measurable amount has occurred - Enter the amount, water equivalent, to nearest hundredths of an inch.

d. Where the 24-hour precipitation is derived from entries in column 44, and where midnight observations are taken, the value entered in column 68 will not include the value entered in column 44 for the first 6-hourly observation.

e. (WB, FAA) This entry may be omitted at second-order stations if the equivalent value is available by summation of the entries in column 44 of the forms constituting the day's record.

* f. (AF) Where no midnight observation is taken and there is an indication that precipitation did occur, enter an estimated 24-hour amount based on the entries in column 44 and prefix the entry with an "E." Enter an explanatory note in block 90; e.g., "E-ESTIMATED-NO MID OBS".

2.69 24-Hour Snowfall (Column 69). Enter the total amount (unmelted) of solid precipitation that has fallen in the 24 hours ending at midnight LST as follows:

a. No 6-hour solid precipitation - Enter 0.

b. A trace but less than 0.05 inch - Enter T and in block 90, when precipitation melted as it fell, enter T-melted as it fell.

c. A measurable amount has occurred - Enter the total amount that has fallen in inches and tenths. Note that it is the total amount that is entered. Therefore, the amount entered will be the amount that has accumulated in the past 24 hours adjusted for any melting or evaporation that has taken place.

d. Prefix estimated amounts with an E and in block 90 enter E-Estimated due to melting.

e. Enter an asterisk as a prefix to the amount if it consists entirely of hail and in block 90 enter, *Hail.

f. Where midnight and four 6-hourly observations are taken daily, this entry is the sum of entries in column 45 exclusive of the entry for the first 6-hourly following midnight, LST. The sum of all trace entries is a trace unless the sum as obtained from recording or totalizing gages equals or exceeds 0.05 inch.

* g. (AF) Where no midnight observation is taken and there is an indication that solid precipitation did occur, enter an estimated 24-hour snowfall based on entries in column 45 and prefix the entry with an "E." Enter an explanatory remark in block 90; e.g., "E-ESTIMATED-NO MID OBS".

2.70 Snow Depth (Column 70). Enter the depth of solid precipitation and ice on the ground at 1200 GMT or, in areas other than the contiguous United States, a time modified as necessary to meet regional needs. Entries are made to the nearest whole inch or as follows:

a. No snow or ice on ground in exposed areas (snow may be present in surrounding forested or otherwise protected areas) enter 0.

b. A trace but less than 0.5 inch on ground in representative areas, enter T.

c. Enter an asterisk as a prefix to the amount if it consists entirely of hail and in block 90 enter, *Hail.

d. (WB, N) Use the 1200 GMT value in column 46 if appropriate.

e. If personnel are not on duty at 1200 GMT, enter depth as measured as near to 1200 GMT as practicable and indicate the GMT time in block 90, e.g., "Column 70 entries observed at 1120 GMT".

* 2.71 Speed of Peak Wind (Column 71). Make this entry only at stations having continuous instantaneous wind-speed recorders. If the record for the day is incomplete, it may still be used provided it is reasonable to assume the missing data did not include the peak wind. Enter in knots the highest instantaneous speed recorded during the 24 hours ending at midnight.

*2.72 Direction of Peak Wind (Column 72). At stations entering data in column 71, enter the direction in tens of degrees. If the direction portion of the recorder is inoperative, estimate the direction from entries in column 9 and enter it to 8 points of the compass.

*2.73 Time of Peak Wind (Column 73). Enter the time of the peak wind, LST, to the nearest minute. If the same speed occurs more than once, enter the time of the last occurrence with a footnote reference and in block 90, enter the additional times.

2.74 (WB, N) Thickness of Ice on Water (Column 74). At designated stations, enter this datum to the nearest inch. Determine thickness from a representative ice layer on a nearby river, lake, or harbor free of artificial influence (such as dredging). Cut a hole in the ice, and measure thickness with a suitable rod or rule. If a new hole is not cut for each measurement, compensate for any artificial accretion of ice near the hole. Measure each Monday near local noon, and more frequently if ice conditions are changing rapidly, or if specifically requested in separate instructions.

2.75 (WB) Frozen Ground Layer, Top (Column 75). At designated stations enter the distance between the surface and the top of the frozen layer in whole inches.

2.76 (WB) Frozen Ground Layer, Base (Column 76). At designated stations enter the distance between the surface and the base of the frozen layer in whole inches.

2.77 (WB) River Gage (Column 77). At designated stations where a river gage is used, enter the river gage reading to the nearest 0.1 foot.

2.78 (WB, N) Sky Cover, Sunrise to Sunset (Column 78). Enter, as a whole number, the tenths of sky cover obtained by averaging the entries in column 21, for the period from sunrise to sunset. Sky cover observations that are made between sunset and sunrise will not be considered in determining the averages entered in column 78. For example, if sunset is at 1640 LST, an evaluation at 1655 LST will not be included in the computation.

2.79 (WB, N) Sky Cover, Midnight to Midnight (Column 79). Enter as a whole number, the tenths of sky cover obtained by averaging the entries in column 21, for the period from midnight to midnight.

*2.80 (WB) Water Equivalent (Column 80). At first-order stations whenever the average snow depth is 2 inches or more (to the nearest inch), enter the water equivalent to the nearest 0.1 inch as measured at approximately 1800 GMT daily. In areas other than the contiguous United States, the time of the observation may be modified as necessary to meet regional needs.

2.81 (WB, N) Local Use (Column 81). When entries are made in this column, identify the entry by completing the heading of the column.

2.82 (WB, N) Precipitation and Thunderstorms (Column 82). Enter the type, character and intensity of each thunderstor n or form of precipitation occurring at the station using abbreviations given in table A3-5 and intensity symbols in table A3-6.

2.83 (WB, N) Time precipitation or Thunderstorms Began (Column 83). Enter the local standard time that the weather, on the same line in column 82, began. If the weather has continued from the previous day, enter "Cont".

2.84 (WB, N) Time Precipitation or Thunderstorm Ended (Column 84). Enter the local standard time that the weather , on the same line in column 82, ended. If the weather continues over into a new day, enter "Cont" in column 83 for the appropriate weather and recopy the type, character and intensity in column 82 for the new day.

2.85 Not used.

* 2.86 (WB, N) Obstructions to Vision (Column 86). When an obstruction to vision occurs at the station, and reduces reported prevailing visibility to less than seven miles, enter the type in this column using abbreviations as given in table A3-5.

* 2.87 (WB, N) Time Obstruction to Vision Began (Column 87). Enter the time an obstruction to vision began (that is the time reported prevailing visibility was reduced to less than 7 miles) in local standard time. If the obstruction to vision began on a previous day, enter "Cont".

* 2.88 (WB, N) Time Obstruction to Vision Ended (Column 88). Enter the time an obstruction to vision ended (that is the time the obstruction ceased to restrict the reported prevailing visibility to less than 7 miles). If the obstruction to vision continues over into the new day, enter "Cont" and copy the type in column 86 of the new MF1-10.

2.89 Not Used.

2.90 Remarks, Notes and Miscellaneous Phenomena (Block 90). Use this block to record the information described below and as indicated in the following paragraphs. All entries will include the time (LST) of occurrence to the nearest minute unless otherwise specified. Entries will be made to explain:

a. Conditions which affect the accuracy of representativeness of recorded data.

b. Outages and/or changes in instruments (include reason for the change).

c. Reason for omission of mandatory data entries.

* d. Time checks of station standard clock if not recorded elsewhere.

2.90.1 Hailstorms. Enter appropriate information concerning the storm including, if known, diameter and weight of largest and average sized hailstone and damage caused.

2.90.2 Tornado, Funnel Cloud or Waterspout. Describe meteorological elements accompanying a tornado, funnel cloud or waterspout, as specified below. If space permits use block 90, otherwise, attach the descriptive material to MF1-10. Include the following:

a. A map showing date, hour of occurrence and path

b. Appearance of clouds

c. Character and amount of precipitation

d. Description of:

(1) Funnel

(2) Appearance of clouds above funnel, and

(3) Distribution of debris.

2.90.3 (WB, N) Harbor Ice. Enter data on quantity, thickness, character, breaks, size of flow, persistence, conditions of aircraft landing area and conditions affecting the transfer of passengers from craft of all types.

2.90.4 (AF) Active Runway and Equipment Changes. Enter the time (LST) and active runway when weather sensor equipment is changed as a result of a change in the active runway. An entry is not required on a new page for the same day of the form unless a change actually occurs. On the first page for each new day, enter the active runway number currently in use.

2.90.5 (WB, FAA) Aneroid Instrument Comparisons. At stations determining altimeter setting values from the lowest pressure reading of two identical or equivalent aneroid devices (see A8-3.4), enter each day on which observations are taken:

a. The reading for each instrument

b. Difference between the readings, and

c. The time of reading.

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CONTENTS

CHAPTER A4. CODING AND DISSEMINATION

FIGURES

3. Aviation Weather Code.

3.1 Coding of Aviation Weather Reports. The same method is used for encoding elements into an aviation report as is used to enter the element on MF1-10 (formerly WBAN Form 10), columns 1 through 13. Table A2-1 indicates the elements included in the various types of reports. In addition, the location identifier, type, and time of observation are included. Observations are coded for transmission as indicated in the following paragraphs.

3.2 Station Identifier. This group indicates the station to which the coded report applies. It consists of two to four letters or numbers and letters. This group is separated from the elements following it by a space.

3.3 Type of Observation. Same as the entry in column 1, MF1-10. The "R" is omitted from record observations when transmitted as part of an hourly sequence. This element is separated from those following it by a space.

3.3.1 (AF) Type of Observation. Type of observation is omitted from all longline transmissions.

3.4 Time of Observation. Same as the entry in column 2, except that it is converted to GMT. It is omitted from reports transmitted in an hourly sequence. The time is separated from elements following it by a space.

3.4.1 (WB) Time of Observation. Time (GMT) is included in all observations taken at SAWR stations.

3.5 Ceiling and Sky Condition. Same as the entry in column 3, MF1-10. It is followed immediately by the visibility.

3.6 Prevailing Visibility.

* 3.6.1 (WB, FAA) Same as entry in column 4a, MF1-10, if an entry has been made in that column. Otherwise, it is the same as the entry in column 4. It is followed immediately by weather and obstructions to vision, or if none are being reported, the visibility is separated from elements following it by a space.

* 3.6.2 (AF,N) Same as the entry in column 4, MF1-10. It is followed immediately by weather and obstructions to vision, or if none are being reported, the visibility is separated from elements following it by a space.

3.7 Weather and Obstructions to Vision. Same as entry in column 5, MF1-10. It is separated from elements following it by a space.

3.8 Sea-Level Pressure. Same as entry in column 6, MF1-10. It is separated from elements following it with a slant.

3.8.1 (AF) Sea-Level Pressure. Include this element only in 3- and 6-hourly observations. This element is not given local dissemination.

3.9 Temperature. Same as the entry in column 7, MF1-10. It is separated from the elements following it by a slant.

3.10 Dewpoint. Same as the entry in column 8, MF1-10. It is separated from elements following it by a slant.

3.11 Wind Direction, Speed and Character. Same as the entries in columns 9, 10 and 11, MF1-10. They are separated from elements following them by a slant.

3.12 Altimeter Setting. Same as the entry in column 12, MF1-10. It is separated from elements following it with a slant. If no data follow it, the slant is omitted.

3.13 Remarks. Same as the entries in column 13, MF1-10. Additive data are separated from preceding remarks or elements by a slant and a space.

3.13.1 (AF) Supplementary Data. Additive data, radiosonde data, and other entries, identified in the handbook, are not normally given local dissemination.

4. Dissemination.

4.1 Dissemination Requirements. Dissemination required for various types of surface weather observations is as follows:

a. Record observations - Local and longline

b. Record special - Local and longline

c. Special - Local and longline

d. Local - Locally determined

* (1) (AF) All local observations taken in accordance with paragraph A2-3.7.3 will be disseminated locally.

e. Correction - Same as report being corrected.

4.1.1 (AF) Data Disseminated Local and Longline by Teletypewriter. Data normally given only local dissemination (e.g., 1-minute RVR) and data given only longline dissemination (e.g., 10-minute RVR) may be included on a single teletypewriter tape when:

a. A local on-base teletypewriter dissemination system is used which is separate from the longline circuit used

b. A tactical weather circuit and a longline circuit are used, or

c. A teletypewriter circuit serves both local and longline dissemination requirements.

* 4.1.2 (AF) Backup Local Dissemination Procedures. The following procedures shall be used when appropriate:

a. When the primary dissemination system (such as auto-writer, local teletypewriter, etc.) is inoperative in the representative observation site (ROS), and the base weather station has transmit capability to air traffic control agencies on the system, relay observations direct to base weather for local dissemination.

b. When the only means of communications in the ROS is voice (such as telephone hotline) disseminate observations immediately to local air traffic control agencies (e.g., Tower, RAPCON, GCA) and then relay the data to base weather for other local dissemination requirements.

* 4.1.3 Unofficial Weather Reports. Unofficial weather reports may be given either local or longline dissemination at the discretion of the observer. However, longline transmissions should be limited to those re-

ports covering sparse data areas, or those indicating unexpected conditions. Each unofficial report disseminated (except tornado, waterspout or funnel cloud reports, which are made in accordance with ¶A7-3.1) shall be identified as to location, time of report and labeled unofficial, using the contraction UNOFFL, e.g., BRJ 1030 UNOFFL E26F. When several such reports are transmitted as a collective, and all the reports in the collective are unofficial, the contraction UNOFFL need only appear in the collective heading.

4.2 Dissemination Priority. All observations shall be given first to the positions which control local air traffic. Priorities for further dissemination may be established by the observer and his supervisor in any order consistent with local and national requirements.

4.2.1 (AF) Local Dissemination of Significant Elements. Any element requiring a special observation and any element considered significant to aircraft operations, will be given immediate local dissemination prior to recording the observation on MF1-10.

4.3 (WB, FAA) Weather Report for Transmission (WB Form B-11). WB Form B-11, Weather Report for Transmission, is used to record observations received from other stations for entry on communications circuits and when used for this purpose, a copy is retained for one month. If the observations are received via a telewriter system, WB Form B-11 need not be used. This form is also a convenient way of delivering an observation to communications personnel where a telewriter system is not used. In such cases, copies need not be retained.

4.4 Use of Telewriter. Whenever available, use the telewriter as the primary means of distributing weather reports locally and to the communications personnel.

4.5 Entry of Observations on Telewriter.

4.5.1 Telewriter Format. Begin each transmission with any address required and then enter:

a. Station call letters

b. Type of observation

* c. Actual time (GMT) of observation

d. Observation report

e. Date and time (GMT) transmission is completed

f. (AF) Initials of observer

g. (WB, FAA) Intrastation identifier as follows:

STATION	IDENTIFIER USED
Weather station	OBS
Communications personnel	COM
FAWS	FAWS
Tower or combined station/tower	TWR
ARTC	ATC
Others	Determined locally

4.5.2 (AF) Identifying Specified Elements. Elements will be entered as follows:

a. Enter magnetic wind direction in three digits, separated from speed by a slant, e.g., 310/05.

b. Enter the contraction "ALSTG" in front of the altimeter setting; e.g., ALSTG 29.96.

* c. If required, enter pressure altitude preceded by the indicator "PA" e.g., PA-30, and PA+120.

4.5.3 Urgent Dissemination of Data. Enter "URGENT" in block letters ahead of all special reports of tornados, funnel clouds, or waterspouts, and other information as indicated by the situation.

4.6 Non-Operational Transmission on Telewriters. Clearly identify all non-operational transmissions as such at both the beginning and the end of the transmission, e.g.,

OBS TEST 123456
ABCDE ←→
END TEST
OBS 172305

4.7 (WB, FAA) Retention of Telewriter Records. Retain records for 90 days; after which time they may be destroyed unless otherwise directed.

4.8 Verification of Transmitted Data. Care should be exercised to avoid, insofar as possible, the dissemination of incorrect data. Immediately after dissemination, recheck the observation and compare it to the disseminated data both longline and local. Whenever possible, also compare the original observation against the longline teletypewriter copy.

4.8.1 (AF) Voice Relay. Where voice relay is used, use a "read back" system to insure that the observation has been correctly recorded at the receiving end. Also prepare one copy of AWS Form 40, Local Dissemination Log, or a tape recording when available to indicate:

a. Actual time of observation

b. Time the observation was transmitted to the tower, and/or other local aircraft control agencies, and the initials of the individual receiving the observations

c. Reasons for delay or non-delivery of observation

d. Initials of observer making entries.

* 4.8.2 Corrections to Transmitted Data. Whenever an error is detected in a transmitted report, disseminate a correction as soon as possible using the same dissemination as that given the erroneous report. However, if such erroneous data is corrected or superseded by a later report (with the same or more complete dissemination), a correction need not be sent.

* 4.8.2.1 Time References in Corrections. To refer to the observation being corrected, use the standard time of record observations or the actual time of special or local observations in the correction report.

4.8.3 (AF) Corrected Reports. Reports corrected longline consist of all data originally transmitted.

* 4.9 (AF, N) Delayed Reports. When it is evident that a weather report will not be completed in time for a scheduled transmission, file the contraction DLAD at the standard time. When the report is ready, file it with the standard time of the observation using appropriate communication procedures.

* 4.10 Reports Filed but Not Transmitted. When transmission of an observation is delayed until time for the next record or special observation, transmit only the latest observation and enter FIBI in parentheses in the remarks of the observation not transmitted. When a special observation is not transmitted over longline, transmit later specials only when the overall change between the last transmitted report and the current report equals or exceeds the criteria for a special observation. Otherwise append FIBI to the current report and disseminate the special locally. Do not FIBI a record (hourly) observation unless a later record observation is available for transmission.

4.11 Communications Failure. If all longline teletypewriter services have failed, telephone (via FTS or AUTOVON if available) or telegraph the first record, record special, or special observation after the failure to the nearest station on the same circuit or circuits with facilities still functioning.

4.11.1 (WB, FAA, N) Additional Transmissions. After initial transmission, send only the 0000, 0600, 1200 and 1800 GMT observations and special observations. All other observations will be taken, recorded, disseminated locally as usual and marked FIBI in column 13.

4.11.2 (AF) Additional Transmissions. After initial transmission send all record, record special and special observations.

4.11.3 (WB, FAA) Commercial Telegraph. When observations are transmitted via commercial telegraph:

a. Spell out all symbols and algebraic signs

b. Omit decimals and slants

c. Send numerical values complete (i.e., as decoded)

d. Replace letter indicators by the word they stand for, e.g., "E" is sent as ESTIMATED, "RW-" is sent as LIGHT RAIN SHOWER, etc.

e. Omit station identification and time.

Recipients of these telegrams will encode the data before longline transmission if it is required.

4.12 Observation Filing Time. All weather reports should be completed and delivered to the communications personnel as soon as possible. Local supervisors may establish longline filing deadlines for scheduled reports; such filing times, however, must be no sooner than that necessary to assure entry of the report in the proper position in the longline sequence collection.

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Figure A4-1. "(WB,FAA,N) Decoding Aviation Weather Reports from Civil Stations

EXAMPLE OF AN OBSERVATION AS FOUND ON HOURLY SEQUENCES

PIT -XM11V⊘38⊕ 7/8VL-FK 146/ 66/65/2713/967/ R10LVR26V55 FK3 /⊘27/CIG 9V12 VSBY 1/2V1

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
WEATHER BUREAU
SILVER SPRING, MD. 20910

DECODING AVIATION WEATHER REPORTS
Based on Instructions in Federal Meteorological Handbook No. 1, Surface Observations

STANDARD AVIATION REPORT FORMAT FOR MANNED STATIONS

STATION IDENTIFICATION: Identifies report for Pittsburgh by using FAA identifier.

TYPE OF REPORT (Table 4): "R" omitted when observation is in hourly sequence.

SKY & CEILING: Partly obscured sky, ceiling measured 1100 ft., variable broken, 3800 ft. overcast. Figures are height of each layer in 100s of feet above ground. A number preceding an X indicates vertical visibility into phenomena. A "V" indicates height varying by amount given in REMARKS. Symbol after height is amount of sky cover (Table 2). The letter preceding height indicates that height to be the ceiling and the method used to determine the height (Table 3).

PREVAILING VISIBILITY: Seven eighths statute mile and variable by the amount given in REMARKS.

WEATHER AND OBSTRUCTIONS TO VISION: Light Drizzle, Fog & Smoke. Symbols used in reporting weather and obstructions to vision are in Table 1. Algebraic signs (Table 1) following symbols indicate intensity.

SEA LEVEL PRESSURE: 1014.6 millibars. Only the tens, units and tenths digits are reported.

DEWPOINT: 65°F;
TEMPERATURE: 66°F. A minus sign indicates temperatures below zero.

WIND: 270° true, 13 kts. To decode direction, multiply first 2 digits by 10. If product is ≥500, subtract 500 and add 100 to speed. Gusts and squalls are indicated by "G" or "Q" following speed and peak speed following the letter.

ALTIMETER SETTING: 29.67 inches. Three figures, representing units, tenths and hundredths of inches, indicate the altimeter setting. "Low" is used preceding figures to indicate values below 29.00 inches.

RUNWAY VISUAL RANGE: Runway 10L, Visual Range variable between 2600 and 5500 ft. in past 10 minutes. When visual range is constant for past 10 minutes, only the constant value is reported, e.g., R10LVR60+.

REMARKS: Fog and Smoke hiding 3/10 of sky.

BASES AND TOPS OF CLOUDS: Tops broken layer 2700 ft. msl. Height of bases not visible at the station precede sky cover symbol. "U" indicates layer amount unknown. If the report is more than 20 minutes old, the time (GMT) precedes the entry.

REMARKS: Ceiling variable between 900 to 1200 feet.

REMARKS: Visibility variable between 1/2 and 1 mile.

TA 8-0-1 (5-70) SUPERSEDES TA 631-0-1 WHICH IS OBSOLETE AND EXISTING STOCK SHOULD BE DESTROYED

PROGRAM 2 AMOS (MANNED FULL- OR PART-TIME)

Format for Teletypewriter Transmissions:

Automatic Data / Manual Data

iii AMOS / TTT/TdTdTd/ddff/PaPaPa /RRR/RmnVVn,n/$h_mhhhC_tC_s$...$h_mhhhC_tC_s$vv..vvWW..WWPPP//

MEH AMOS /74/66/3602/996/012/R36VV1,3//M10Φ 11/2TRW-GF293//TB51 W MOVG E FQT LTGCC

	Data Reported and Explanatory Notes[2]	Symbolic Form	Coded Data	Decoded Data
AUTOMATIC DATA	Station designator.	iii	MEH	Meacham, Oregon.
	Type designator.		AMOS	Automatic Meteorological Observing System followed by 22 spaces.
	Dry-bulb temperature (hundreds, or space or minus,[3] tens and units).	TTT	74	74°F.
	Dew-point temperature (space or minus,[3] tens and units).	TdTdTd	66	66°F.
	Wind direction (degrees) and speed (knots).	ddff	3602	Wind from 360° at 2 knots.
	Altimeter setting, units, tenths and hundredths in. Hg.	PaPaPa	996	29,96 inches of mercury.
	Cumulative precipitation (units, tenths and hundredths of inches liquid state) for 6-hr. period beginning 0000, 0600, 1200 & 1800 GMT.	RRR	012	0.12 inch of precipitation (melted amount if catch is solid state).
	Instrument runway number, when appropriate.	Rnn[4]	R36	Runway number 36 (visibility follows).
	Runway visibility in statute miles and tenths for foregoing runway.	VVn,n	VV1,3	Visibility on runway 36 is 1,3 statute miles.
MANUALLY DETERMINED DATA	Ceiling designator, prefixed to ht. (if known) and to amount symbol for layer to which designator applies.	h_m (See Footnote 1)	M	Measured ceiling (height and/or character and amount follows).
	Height of first[1] layer at or above surface (in hundreds of feet), followed by "V" when rapidly variable.	hhh (See Footnote 1)	10	1000 ft. (character and amount follows).
	Thickness indicator, when appropriate, i.e., "-" identifies "thin" layers aloft or "partial" obscuration at surface, otherwise it is omitted.	C_t (See Footnote 1)	(omitted)	Layer not evaluated as "thin."
	Sky cover amount 0,1-0,5 = Φ, 0,6-0,9 = Φ, 10/10 = Φ, "X" = 10/10 surface-based obscuring phenomena, "-X" = less than 10/10 surface-based obscuring phenomena.	C_s (See Footnote 1)	Φ	Broken sky cover aloft (0,6 to 0,9) of sky covered by sky cover aloft and hidden by surface-based obscuring phenomena at and below level reported.
	Prevailing visibility, in statute miles and fractions, followed by "V" when rapidly variable.	vv..vv	1 1/2	1 1/2 statute miles.
	Weather and obstructions to vision.	WW..WW	TRW-GF	Thunderstorm "T", light rain showers "RW-", ground fog "GF".
	Sea-level pressure, tens, units and tenths of millibars), where not determined automatically.	PPP	293	1029,3 millibars.
	At manned AMOS locations appropriate remarks are appended to the observation following the two slants.		TB51 W MOVG E FQT LTGCC	Thunderstorm began 51 minutes after preceding hour, it is west of the station moving toward the east, with frequent cloud to cloud lightning.

[1]The "$h_m h h h C_t C_s$" group is repeated for other layers present, in ascending order of height.

[2]More detailed information is contained in the Federal Meteorological Handbook #1, Surface Observations, and on page 3 of this TA.

[3]Reports of below zero temperatures may appear either as "minus" temperatures or as the algebraic sum of 100 and the temperature, e.g., a dewpoint temperature of -10°F would be reported as -10 from some stations, but as 90 (i.e., 100-10) from others. Temperatures above 99°F are reported either as three figures (e.g., 102° reported as 102) or by omitting the hundreds figure (e.g., 102° reported as 02).

[4]Where directional visibility is not associated with a runway, "Rnn" is coded as RNO in lieu of a runway number.

TABLE 1

WEATHER SYMBOLS

T	Thunderstorm	RW	Rain Showers
T+	Severe Thunderstorm	S	Snow
A	Hail	SG	Snow Grains
IC	Ice Crystals	SP	Snow Pellets
IP(W)	Ice Pellets (Showers)	SW	Snow Showers
L	Drizzle	ZL	Freezing Drizzle
R	Rain	ZR	Freezing Rain

OBSTRUCTIONS TO VISION

BD	Blowing Dust	H	Haze
BN	Blowing Sand	D	Dust
BS	Blowing Snow	F	Fog
BY	Blowing Spray	GF	Ground Fog
K	Smoke	IF	Ice Fog

WEATHER INTENSITY SYMBOLS

--	Very light	Absence of symbol indicates moderate except for T, A and IC
-	Light	
+	Heavy	

TABLE 2

SKY COVER SYMBOLS

-X	Partly obscured sky (0,1 to 0,9 sky hidden by surface-based obscuration)
X	Obscuration (1,0 sky hidden by surface-based obscuration)
○	Clear (0,0 sky cover)
◑	Scattered (0,1 to 0,5 sky cover)
◕	Broken (0,6 to 0,9 sky cover)
●	Overcast (1,0 sky cover)

A minus sign (-) preceding a ◑, ◕ or ● symbol indicates that layer is thin, i.e., 1/2 or more of the summation amount for that level is thin

TABLE 3

CEILING DESIGNATORS

M	Measured	B	Balloon
A	Aircraft	E	Estimated
W	Indefinite	R	Radar

TABLE 4

TYPES OF REPORTS

R	Record	S	Special
L	Local	RS	Record Special

PROGRAM LAMOS (MANNED STATIONS ONLY)

Format for teletypewriter transmission:

Manually Observed Data[1]	Automatically Observed Data

iii $b_m$hhhhC$_t$C$_s$ hhhC$_t$C$_s$ vvvvWWWWWW PPP/TTT/$T_dT_dT_d$/ddff/$P_aP_aP_a$/RRR/RunVVnn//

Manually Observed Data[1, 4, 6]

Remarks and scheduled additional data whenever appropriate.

Example of transmitted report:

ORH M 10 220 11 2 FRW-GF 293/ 64/ 64/3011/0.39/001/ R33VV0,6 //VSBY 1V2
TB5I W MOVG SE FQT LTGCG SW

Data Reported and Explanatory Notes	Symbolic Form	Coded Data	Decoded Data
Station Designator.	iii	ORH	Worcester, Massachusetts.
Ceiling designator (prefix to known heights of ceiling layer).	b_m	M	Height of layer measured as:
Height of first layer reported, hundreds of feet.	hhh	10	1000 feet.
Thickness indicator, i.e., "-" identifies a layer aloft as "thin" or Surface-based obscuring phenomena (X) as partial.	C_t	(blank)	
Sky cover amount, lowest layer (0,1-0,5 - ⌀, 0,6-0,9 - ⊕, 10/10 - ●, X - surface-based obscuring phenomena).	C_s	⊕	Broken sky cover (0,6 to 0,9 of sky covered by obscuring phenomena at and below preceding height).
Ceiling designator (prefix to known heights of ceiling layer)	b_m	(blank)	
Height of second layer reported, hundreds of feet.	hhh	220	Sky cover height 22,000 feet.
Thickness indicator, i.e., a "-" identifies layer as "thin"	C_t	(blank)	
Sky cover amount, second layer (0,1-0,5 ⌀, 0,6-0,9 ⊕, 10/10 ●), or clear sky (zero tenths of sky cover ○).	C_s	●	Overcast sky cover (100% of sky covered by cloud or hidden by obscuring phenomena at and below preceding height).
Prevailing visibility (statute miles).	vvvv	1 1/2	1 1/2 statute miles.
Weather and obstructions to vision.	WWWWWW	FRW-GF	Thunderstorm (T), light rain showers (RW-), ground fog (GF).
Sea-level pressure, tens, units and tenths of mb.	PPP	293	1029,3.
Temperature, hundreds, tens, and units °F.[2]	TTT	64	+64°F.
Dew-Point temperature, hundreds, tens.	$T_dT_dT_d$	64	+64°F.
Wind direction and speed.	ddff	3011	300°, 11 knots.
Altimeter setting, units, tenths, and hundredths inches of mercury.	$P_aP_aP_a$	039	30,39 inches of mercury.
Cumulative precipitation (units, tenths, and hundredths inches) for six hour periods beginning 0000, 0600, 1200 and 1800 GMT.	RRR	001	0,01 inch of precipitation (liquid measure).
When a transmissometer is available for runway visual range is not applicable, runway visibility in miles and tenths is reported.	RunVVnn	R33VV0,6	Visibility on runway 33 is 6/10 mile.

MANUALLY OBSERVED — See Footnote 3

AUTOMATICALLY OBSERVED

PROGRAM LAMOS (MANNED STATIONS ONLY)

MANUALLY OBSERVED

Miscellaneous

Remarks added by observer in standard format and using standard weather symbols given in Federal Meteorological Handbook #1, Surface Observations, and authorized teletypewriter contractions, as given by FAA in "Contractions Manual".[3] In the ORH example above the remarks portion, (VSBY 1V2 TB51 W MOVG SE FQT LTGCG SW) reports the following supplementary information:

VSBY 1V2 = Prevailing visibility is variable from one to two statute miles,

TB51 = Thunderstorm began 51 minutes after the preceding

W MOVG SE = Thunderstorm to west of station, moving toward the southeast

FQT LTGCG SW = Frequent lightning from cloud to ground southwest of station

[1]Manually observed data groups "drop out" at stations having limited hours of operation to leave blank spaces in columnized format during hours when personnel are not on duty. PPP is only included in reports from selected stations.

[2]Normally, the first column of each of the 3-column code groups TTT and $T_dT_dT_d$ is reserved for use of the figure "1" when temperatures exceed "99", or for "-" when temperatures are less than 0°F. A zero (0) appears in the second column when temperatures range from +9°F to -9°F. Otherwise, at some stations, sub-zero temperatures appear as the algebraic sum of 100 and the temperature (e.g., -8°F would be reported as 92, i.e., the sum of 100 and -8); for temperatures above 99°F, the hundreds figure is omitted (e.g., 102°F is reported as 02).

[3]Scheduled coded data (in 3- to 5-figure code groups) are appended at selected stations, following remarks, in accordance with FMH #1, Chapter 3. These code groups are not of direct concern for aircraft operations.

[4]The lowest of the following layers (a) the lowest cloud layer covering 0.1 or more of the sky, or (b) the lowest layer of obscuring phenomena (aloft or on the surface) hiding 0.1 or more of the sky.

[5]The ceiling layer, if any, whenever it is not reported by the first sky cover group; otherwise, an operationally significant group. When more than two layers are present additional layers are reported as remarks.

[6]See page 3 for explanation of selected standard weather symbols. Further information is contained in the Federal Meteorological Handbook, #1, Surface Observations.

CONTENTS

CHAPTER A5. SKY CONDITION

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DIAGRAMS

TABLES

FIGURES

2.5.3 E - Estimated Ceiling. A ceiling height determined by a method not considered representative or reliable enough to justify the use of another classification. Included in this category are values

a. Determined on the basis of observer experience

b. Determined by means of the "Convective Cloud Height Diagram" (Diagram A5-1)

c. Based on cirriform ceiling heights obtained by M, A, R or B methods when the values are more than one hour but not more than six hours old when entered on MF1-10 provided, in the judgment of the observer, there has been no evident appreciable change in altitude

d. Based on the penetration of the ceilometer or ceiling-light projector beam when it is in excess of normal for the particular height and type of layer present, or the penetration equals or exceeds an elevation angle corresponding to approximately 10 times the baseline to the nearest degree

e. Based on the use of pilot balloons with lights attached or on the rate of ascent of balloons during precipitation heavier than light or very light, during the occurrence of hail, or any intensity of ice pellets or freezing rain.

2.5.4 M - Measured Ceiling. A ceiling height either determined instrumentally with a cloud-height indicator or based on the known heights of objects within 1 1/2 nautical miles of a runway of the airport.

2.5.5 R - Radar Ceiling. A ceiling height determined from a cloud detection radar considered by the operator to be of optimum reliability and, in the judgment of the observer, considered to be probable on the basis of visual observation.

2.5.6 W - Indefinite Ceiling (Obscured Sky). A ceiling value representing either

a. The vertical visibility upward into surface-based obscuring phenomena, or

b. The maximum vertical height above the ground within 1 1/2 nautical miles of a runway of the airport and within 15 minutes of the actual time of an observation from which a pilot in a surface-based

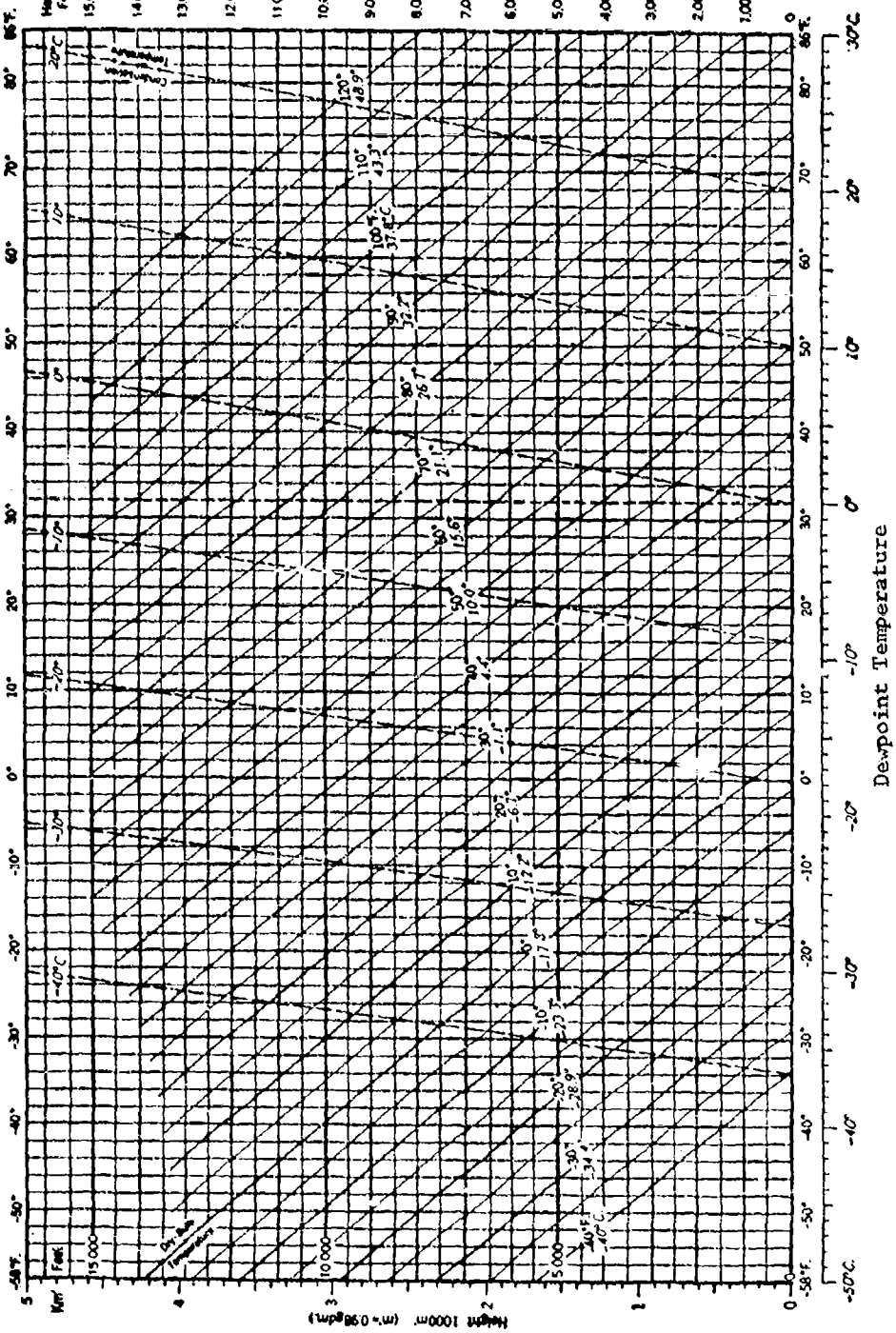

Diagram A5-1. Nomogram for determination of height of convective-type clouds. Convert sub-freezing dewpoint temperatures from a water to ice basis, by means of Table 5-2, for use in this nomogram.

2.21 Thin Sky Cover. That portion of sky cover through which higher clouds, blue sky, etc. can be discerned.

* 2.22 Variable Sky Condition. A term used to describe a sky condition which has varied between reportable conditions (e.g., ◔ to ◕, etc.) during the period of observation (normally the past 15 minutes).

2.23 Summation Principle. This principle states that the sky cover at any level is equal to the summation of the sky cover of the lowest layer plus the additional sky cover present at all successively higher layers up to and including the layer being considered. No layer can be assigned a sky cover less than a lower layer, and no sky cover can be greater than 1.0 (10/10). This concept is applicable for the evaluation of both total sky cover and total opaque sky cover.

2.24 Surface. For height determinations, the term "surface" denotes the horizontal plane whose elevation above sea level equals the field elevation. At stations where the field elevation has not been established, "surface" will refer to the ground or elevation at the observation site. At sea-plane bases, the mean high-tide mark may be regarded as the surface.

2.25 Vertical Visibility. Vertical visibility is either:

a. The distance that an observer can see vertically upward into surface-based obscuring phenomena such as fog, blowing dust or sand, precipitation forms, etc., or

b. The height corresponding to the upper limit of a ceilometer reaction, the top of a ceiling light projector beam, or the height at which a balloon completely disappears during the presence of surface-based obscuring phenomena (obscured sky), or

c. The maximum vertical height above the ground from which a pilot in a surface-based obscuring phenomenon (obscured sky) can discern the ground.

* 2.26 Radar Cloud Detection Report (RCD). A report of the height of cloud bases and tops determined with radar equipment and appended to aviation weather observations.

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c. Repeat the evaluation in b. for each additional layer present in ascending order of height. Estimate the summation tenths of sky covered and hidden by each layer, in combination with all lower layers.

d. Determine for each layer present whether it should be classified as "thin" or "opaque." This evaluation shall be based on the ratio of total opaque to total sky cover summation amounts at and below the level of each layer present up to and including the layer being classified (see table A5-2).

3.6 Cloud Direction. These instructions are normally applicable only at those stations in WMO Region V, Southwest Pacific that encode the $7RRD_LD_M$ synoptic code group (table A3-17).

3.6.1 Cloud Direction Determination. Observe the movement of clouds past a structure whose orientation is known. When clouds are moving slowly, their direction can be determined with reasonable accuracy by taking several observations a few minutes apart, and noting the relative position of the clouds with respect to the previous observations.

3.7 Determination of Ceiling Heights. The methods indicated in these instructions will be used in determining the heights of clouds and/or obscuring phenomena aloft and the vertical visibility in surface-based obscuring phenomena. The rotating-beam ceilometer normally shall be used for determining cloud layer heights and vertical visibility in obscuring phenomena. If a ceilometer is not available, these values should be obtained by the most reliable and possible alternative method. This will usually be with the ceiling light or a pilot balloon with light attached at night, and with a balloon in the daytime. Heights of layers visible at the station will be reported in terms of feet above the surface (not above mean sea level) rounded to the reportable values specified in table A3-2. Use the ceiling height designators listed in table A3-3.

* 3.7.1 Aircraft (A) Ceiling Heights. Convert pilot reports of ceiling heights above mean sea level to reportable values (table A3-2) above the surface when using these heights as aircraft ceilings.

* 3.7.2 Balloon (B) Ceiling Heights. If the ceiling cannot be determined with a ceiling light, ceilometer, radar, raob balloons, or from pilot reports, ceiling or pilot balloons shall be used:

a. At stations taking hourly observations whenever:

(1) The ceiling is at or below the minimum height for VFR applicable to the control zone in which the station is located, or

(2) The ceiling height is 2,000 feet or less and the presence of a stratus-type cloud layer makes estimation difficult.

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Table A5-2. Examples of Summation of Sky Cover

Totally Opaque Sky Cover

Layers	Summation	Sky Cover Symbol Entries (Col. 3)
(1) 0.4 sky hidden by fog 0.3 sky cover at 1,000 feet 0.2 sky cover at 5,000 feet	0.4 0.7 0.9	Enter "F4" in Col. 13 -XM10⓪50⓪
* (2) Less than 0.1 (.02) sky cover at 500 feet Less than 0.1 (.04) sky cover at 2,000 feet 0.5 sky cover at 3,000 feet Less than 0.1 sky cover at 25,000 feet	0.0 0.1 0.6 0.6	Enter "STFRA W" in Col. 13 20⓪E30⓪250⓪
(3) 0.6 sky cover at 1,000 feet 0.3 sky cover at 5,000 feet 0.1 sky cover at 30,000 feet (with breaks)	0.6 0.9 1.0	Enter "BINOVC" in Col. 13 M10⓪50⓪300⊕
(4) 0.1 sky cover at 1,000 feet (smoke aloft) 0.3 sky cover at 5,000 feet 0.1 sky cover at 35,000 feet	0.1 0.4 0.5	Enter "K10⓪" in Col. 13 10⓪50⓪350⓪
(5) 0.2 sky cover at 500 feet Sky hidden by snow, vertical visibility 1,500 feet	0.2 1.0	5 ⓪W15X
(6) 0.8 sky hidden by snow 0.2 sky cover at 500 feet	0.8 1.0	Enter "S8" in Col. 13 -XM5⊕

Partly Opaque Sky Cover

Layers	Summation Opaque	Summation Total	Ratio of Total Opaque to Total	Sky Cover Symbol Entries (Col. 3)
(7) 0.8 sky cover at 500 feet (0.0 opaque)	0.0	0.8	0/8	5-⓪
(8) 0.1 sky hidden by surface smoke	0.1	0.1	1/1	Enter "K1" in Remarks
0.7 sky cover at 1,000 feet (0.1 opaque)	0.2	0.8	2/8	
0.2 sky cover at 5,000 feet (all opaque)	0.4	1.0	4/10	-X10-⓪50-⊕
(9) 0.4 sky cover at 1,000 feet (0.2 opaque)	0.2	0.4	2/4	
0.2 sky cover at 2,000 feet (0.2 opaque)	0.4	0.6	4/6	
0.2 sky cover at 25,000 feet (0.0 opaque)	0.4	0.8	4/8	10-⓪E20⓪250-⓪
0.2 sky cover at 40,000 feet (0.2 opaque)	0.6	1.0	6/10	400⊕

a. By means of the convective cloud height diagram (diagram A5-1). This diagram eliminates the computation necessary in determining height of convective-type clouds by use of a dewpoint formula. It is not suitable for use at stations situated in mountainous or hilly terrain. This method should be used only when the clouds present are formed by active surface convection in the vicinity of the station. This diagram is usually most accurate when used to compute the height of cloud bases at 5,000 feet or less. Obtain the estimated height of a cloud base above the point of observation as follows:

(1) Locate the point of intersection of the vertical line (abscissa) corresponding to the observed dewpoint temperature, and the curve (sloping upward to left) corresponding to the observed dry-bulb temperature.

(2) Find the height of the convective cloud base above the ground at the scale value (printed along the right side of the chart) corresponding to the point found in a.

b. From the known heights of unobscured portions of natural landmarks or objects more than 1 1/2 nautical miles from any runway of the airport.

c. On the basis of observational experience; provided the sky is not completely hidden by surface-based obscuring phenomena; and other guides are lacking or, in the judgment of the observer, are considered to be unreliable.

d. By the use of pilot balloons with lights attached, or during conditions when ceiling or pilot balloon ascensional rates may have been affected by occurring precipitation.

e. By ceilometer or ceiling light and the penetration of the light beam is in excess of normal for the particular height and type of layer present.

f. By ceilometer or ceiling light and the values equal or exceed 10 times the baseline used.

* g. From weather-surveillance radar range height indicator (RHI) scope displays. Such height indications seldom compare well with indications from cloud height measuring equipment for heights below 10,000 to 12,000 feet. RHI displays are also not reliable for detecting the heights of cirroform clouds. Ordinarily, RHI indications are most useful as an aid to the observer in evaluating the heights of middle clouds.

* h. From cloud detection radars when the heights are not considered sufficiently reliable to warrant use of a "radar" height classification.

i. Based on cirriform ceiling heights obtained by M, A, R, or B methods when the values are more than one hour but not more than six hours old provided, in the judgment of the observer, there has been no evident appreciable change in height. When evaluations of cirriform ceiling heights cannot be based on these methods, they will be estimated on the basis of observer experience.

3.7.4 Measured (M) Ceiling Heights. Ceiling values are classified as "measured" when

a. Determined from ceilometer or ceiling light values of less than ten times the baseline, or

b. Based on the known heights of unobscured portions of abrupt, isolated objects (buildings, towers, etc.) within 1 1/2 nautical miles of an airport runway.

3.7.4.1 Ceiling Heights from Ceilometers. The response of ceilometer recorders and CRT (cathode-ray tube) indicators to light reflected from clouds and obscuring phenomena is illustrated in figures A5-1 through A5-11. The base of sky cover aloft is represented by points of maximum reaction of the ceilometer to light reflected from the base of layers detected.

a. The average vertical extent of the brightest portion of the spot produced by a ceiling light or ceilometer projector is approximately 300 feet. While it is not an absolute standard, this value may be used as the basis for determining if the light beam penetration is in excess of normal for the height and type of layer present.

b. Data obtained from ceilometers or ceiling lights should be supplemented by visual observations to determine that the instrumental values are representative of the layer to which they are ascribed.

c. When the sky is obscured by a surface-based layer, the ceilometer reaction is usually at a maximum at low angles and decreases slowly to a zero amplitude as the angle increases. This minimum deflection is at zero degrees on rotating-beam ceilometer CRT scopes. The absence of a reaction during low visibility conditions does not necessarily indicate that projector lamps are defective. Obscuring phenomena that reduce the visibility to less than the ceilometer baseline length w ill completely attenuate the projected light beam.

d. During outages of the rotating beam ceilometer, if a rotating beam ceilometer is available for an alternate runway, it may be used provided, in the judgment of the observer, the measurements are considered to be representative of conditions an aircraft will encounter during landing approach.

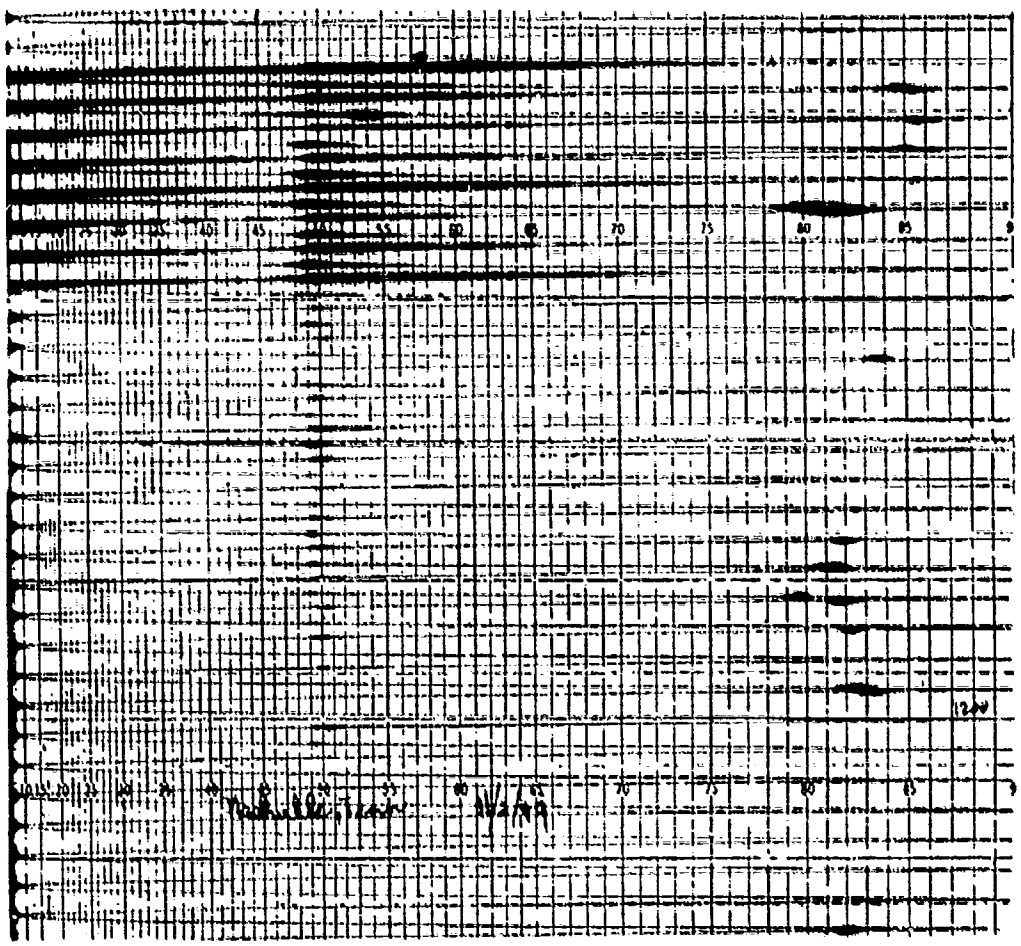


Fig. A5-10. (WB,N) Refraction phenomena, elevation angle 49° (Weather Bureau ceilometer).

Fig. A5-11. (WB, N) Extraneous reactions (Weather Bureau ceilometer).

e. Ceilometer reactions, such as might be caused by equipment malfunctioning, can usually be identified by dissimilarity with patterns caused by meteorological phenomena. They usually occur only occasionally and may be intensified by high gain control settings of the recorder or CRT-scope.

f. False or misleading maximum ceilometer reactions may be caused by nearby, high-intensity, flashing runway lights.

(1) Flasher interference occurs at 15° intervals on both the recorder trace and the CRT-scope of the rotating beam ceilometer.

(2) The reactions on the CRT-scope are in the form of pyramid-like deflections that taper off rapidly with increasing elevation angle. Those on the recorder trace appear as either dark maximum (dashed line) or tone level (solid line) signals of equal length.

(3) The RBC recorder is equipped with a Flash Filter for minimizing the effect of flasher interference signals, However, it should be used only when necessary since it affects the sensitivity of the recorder.

(4) When flasher interference reactions are superimposed on signals from clouds that are present, the uniformity of the flasher interference signals should assist the operator in determining the angular elevation of the clouds.

g. The refraction of light from the projected beam by raindrops may produce a strong enough signal to cause a reaction on the ceilometer recorder trace or the CRT-scope. These reactions occur with greatest intensity at an elevation angle of 45°. This primary reaction is without regard to the baseline length or the height of the detector above or below the projector. Weak secondary reactions may also appear at approximately 36°. Ceilometer deflections from clouds at these angles are generally stronger than those from refraction phenomena, w hich may usually be eliminated by low gain control settings without significant weakening of cloud reactions.

3.7.4.2 RBC CRT-Scope Evaluation. Use the following procedure for evaluating RBC CRT-scope presentation of sky-cover reactions:

a. For heights of sky cover layers aloft:

(1) When reactions from a single broken or overcast layer are present, consider the spot of maximum deflection on the scope as an instantaneous height value. Determine a mean height value by averaging as many angular readings as are available during the period of evaluation.

(2) For scattered clouds, use as many scope reactions as are available during the period of evaluation to obtain ar average height.

(3) When multiple layers are present, supplement scope height indications with visual observations. Average only those reactions which are considered applicable for the layer whose height is being determined.

b. When the sky is completely hidden by surface-based obscuring phenomena:

(1) Consider the point at which deflection on the scope becomes zero as an evaluation of vertical visibility.

(2) Use the average value obtained from at least four consecutive sweeps as a representative indefinite (W) ceiling height.

*3.7.5 Radar (R) Ceiling Heights. Classify ceiling heights as "radar" when determined from cloud detection radar equipment and the following criteria are satisfied:

a. The values are considered by the radar operator to be reliable

b. The values are considered by the observer to be representative of conditions at the station as based on visual observations

3.7.6 Indefinite (W) Ceiling Heights. Ceiling values are classified as "indefinite" when the vertical visibility in a surface-based obscuring phenomenon is

a. The distance that an observer at the ground can see upward into an obscuring phenomenon completely concealing the sky

b. Based on the visible portions of nearby objects (buildings, control towers, etc.) on the airport complex

c. Based on a height equivalent to a ceilometer upper limit reaction, the top of a ceiling light beam, or the height at which a balloon completely disappears, or

d. Based on the maximum vertical height above the ground within 1 1/2 nautical miles of a runway of the airport and within 15 minutes of the actual time of an observation from which a pilot in a surface-based obscuration (obscured sky condition) can discern the ground. These pilot report values need not be used if, in the judgment of the observer, they are not representative of conditions over the airport.

3.8 Variable (V) Ceiling Heights. Only heights of less than 3,000 feet will be reported as variable, using the average of all observed values as the ceiling. Rapid fluctuation of ceilometer indications, or of the spot from a ceiling-light projector, will indicate an irregular base whose height will be regarded as measured but variable.

*3.9 Sky Cover Data Not Visible at the Station. Pilot or radar reports of bases not visible at the station and/or tops of sky cover may be used when they are within 20 nautical miles of the airport (within 50 miles for cirriform layers). The unconverted (MSL) heights should be encoded for longline transmission in remarks of the next scheduled observation. If these data are transmitted during a scan period (included in a special observation), append these data, if still considered valid, to the next record observation.

CONTENTS

CHAPTER A6. VISIBILITY

3. Observing and Reporting Procedures.

3.1 Unit of Measure. Report prevailing or sector visibility in statute miles at land stations and in nautical miles on naval and ocean station vessels and other specifically designated locations.

3.2 Observing Aids. Post charts, lists or other positive means of identifying lights or objects used as reference markers in determining visibility near the observing position. At local discretion, separate lists or charts for day or nighttime use may be prepared.

3.3 Control Tower Aids. Where control tower visibility is reported, separate charts or lists are needed using the control tower as the observation site.

3.4 Observation Sites. Visibility observations should be taken from as many locations as are necessary to view all reference markers. Where practicable, these evaluations should be with reference to a plane six feet above the ground. Observations taken from the roof of a building or at the control tower level are exceptions to this standard.

* 3.5 Estimations of Visibility. When the visibility is greater than the distance to the farthest reference marker, note the sharpness with which the marker stands out. Sharp outlines in relief with little or no blurring of color, indicate that the visibility is much greater than the distance to the reference object. A blurred or indistinct object indicates the presence of an obstruction to vision that has reduced the visibility to not much more than the distance to the object. Do not estimate visibilities beyond whichever of the following is the greater:

a. 7 miles, or

b. twice the distance to the most distant visible visibility marker.

3.6 Visibility Markers During Daylight. Dark, or nearly dark objects outlined against the horizon sky, are preferred for daytime visibility evaluations. However, the use of less ideal markers is usually necessary in order to obtain a representative value for each sector.

3.7 Dark Adaptation. Before taking a visibility observation at night, the observer should spend as much preliminary time outdoors, as practicable, for accommodation of his eyes to the darkness.

3.8 Visibility Markers at Night. The most suitable objects for determining visibility at night are unfocused lights of moderate intensity at known distances. The red or green "course lights" of airway beacons, TV and radio tower obstruction lights, etc. may be used as definite nighttime visibility markers. Because of their intensity, focused lights, such as airway beacons,

may not be used as visibility markers. However, their degree of brilliance may be used as an aid to indicate whether the visibility is greater or less than the distance to the light source.

3.9 Determination of Prevailing Visibility. After visibilities have been determined around the entire horizon circle, they are resolved into a single value for reporting purposes. In uniform conditions, the determination of prevailing visibility is relatively simple since it will be the same as that in any direction. If the visibility is variable, the prevailing visibility is the average of all observed values.

3.10 Determination of Sector Visibility. In non-uniform conditions one method for determining prevailing visibility is to divide the horizon circle into several sectors, each of which has substantially uniform visibility. Transmissometer data may also be used as an aid in determining the visibility for the sector in which the instrument is installed. This use is dependent upon the transmissometer value being less than two miles and a uniform visibility throughout that sector.

* 3.11 (WB, FAA) Control Tower Observations and Actions. Unless otherwise exempted, certificated tower personnel shall report prevailing visibility when the prevailing visibility at the usual point of observation or at the tower level is less than four miles. These control tower visibility observations may be used immediately for aircraft operations but they shall be recorded and forwarded to the weather station as soon as practicable. During this condition, control tower personnel shall notify the weather station as soon as possible when they observe the prevailing visibility at the tower level to decrease to less than four miles, and change by one or more reportable values (table A3-4). When the tower visibility is reported as variable, subsequent actual observed values within the limits of the reported variability need not be transmitted to the weather station.

3.12 (WB, FAA) Additional Tower Personnel Action. Tower personnel shall also record on graphic transcription equipment, MF1-10, or a separate tabulation sheet, the following information for each control tower visibility observation:

a. Time of observation

b. Prevailing visibility at the tower level

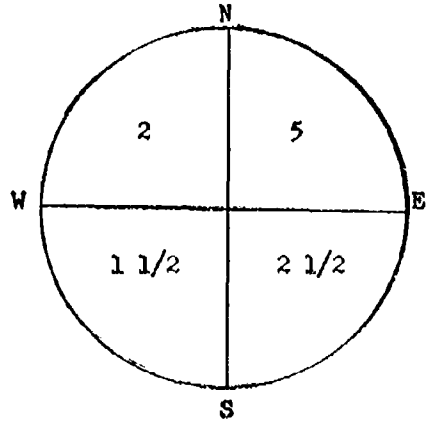
c. Remarks (such as visibility in different sectors)

d. Observer's initials.

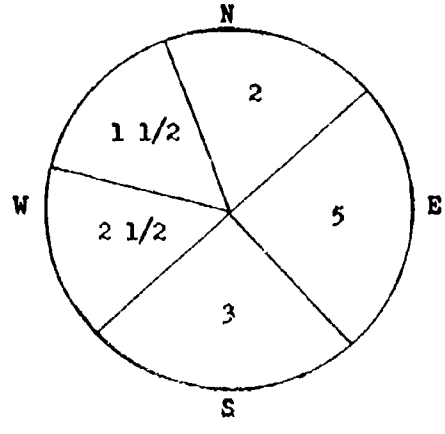
* EXAMPLES - Determination of Prevailing Visibility

Prevailing visibility indicated by an asterisk.

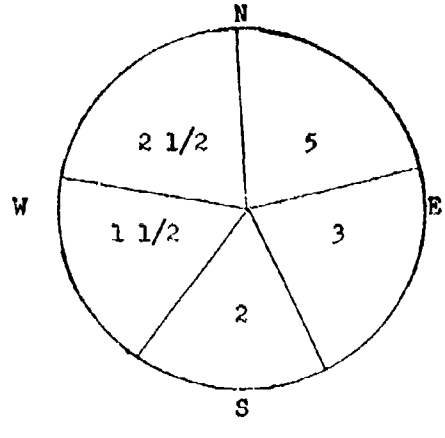
Four Sectors	
Visibility	Approximate Degrees Azimuth
5	90
2 1/2*	90
	180
2	90
1 1/2	90



Five Sectors	
Visibility	Approximate Degrees Azimuth
5	100
3*	90
	190
2 1/2	60
2	50
1 1/2	60



Five Sectors	
Visibility	Approximate Degrees Azimuth
5	72
3	72
2 1/2	72
	216
2	72
1 1/2	72



* 3.13 (WB, FAA) Weather Station Action at Control Tower Stations. Weather station personnel shall:

a. Notify the tower as soon as possible, whenever the prevailing visibility at the weather station observation point decreases to less than, or increases to equal or exceed, four miles.

b. Re-evaluate weather station prevailing visibility, as soon as practicable, upon initial receipt of a differing control-tower value, and upon receipt of subsequent reportable changes at the control tower level.

c. Use control-tower values of prevailing visibility as a guide in determining a weather station value where the observer's view of portions of the horizon is obstructed by trees, buildings, etc. The presence of a surface-based obstruction to vision that is uniformly distributed to heights above the level of the tower is sufficient reason for evaluating the weather station prevailing visibility to be the same as that at the control tower level.

d. (WB) Arrange for retention of records of control tower observations for a minimum of 30 days. After they have been compared with entries on the weather station MF1-10, the control tower records may be destroyed.

3.14 Reporting Runway Visibility (RVV). Report RVV when:

a. (WB, FAA, N) It is less than two miles along the identified runway, or the prevailing visibility is less than the highest instrument minimum for the identified runway.

* b. (AF) Prevailing and/or runway visibility is one mile or less and:

(1) RVR minimums have not been published for an instrumented runway in use, or

(2) When RVR is unavailable and visual RVV observations are required in accordance with ¶3.17.1.

3.14.1 Transmissometer Stations. Normally, RVV should not be reported at any station where RVR is reported from at least one runway. An exception may be made when an obscuring phenomenon such as fog persistently covers only one portion of the airport. When this condition results in either the RVR or RVV equipped runway being substantially better than the other, both RVR and RVV should be reported. This procedure will advise the user as to the disparity in visibility conditions at the airport.

3.15 RVV Observational Technique.

3.15.1 (WB, FAA, N) Direct Indicating Meters and Recorders. From "visibility" meters and recorders equipped with "day and night" scales, read runway visibility to the nearest reportable value given in table A3-4.

3.15.2 Transmissivity Conversion. Where or when ¶3.15.1 is not applicable, read transmission to the nearest 1/2 percent, from the recorder trace or "transmission" meter. Use a table appropriate to the baseline to convert transmission to runway visibility. Apply background correction to transmissivity before entering the table.

a. (WB, FAA, N) Use table A3-8A, B, or C. Request tables for other baselines from appropriate headquarters.

* b. (AF) Use table A3-9A, B, or C.

3.15.3 Use of Day or Night Scale. In determining runway visibility or runway visual range, the observer must select the appropriate time for changing from day to night values or vice versa. In general, the day scale should be used in the evening until low intensity lights on or near the airport complex are clearly visible, and the night scale should be used in the morning until these lights begin to fade.

3.15.4 Transmissometer Determination. Transmissometer determined runway visibility values are applicable only to the specified runway(s) near which the instrument is located. When the observer has reliable reports or has otherwise determined that the instrumental values are not representative for the associated runway, the data shall not be used.

3.15.5 (AF) Transmissometer HIGH Mode Operation. Place the transmissometer RANGE SWITCH in the HIGH mode when transmissivity is less than 15%. Transmissivity values obtained from either the recorder or meter while in the HIGH mode, must be divided by five before entering transmissivity tables.

3.15.6 (AF) Visual Determination. If RVV cannot be obtained instrumentally, make visual observations when:

a. RVV is considered necessary to meet an immediate operational requirement, and

* b. The base commander (or his authorized representative) directs an observer, or non-weather personnel certified in accordance with AWSR 50-10, to make the visual observations.

3.15.7 (AF) Visual Observations. Standing at the runway edge at the threshold of the in-use runway, obtain reportable RVV values by counting HIRL (on the current light setting) along the opposite side of the runway. If HIRL are inoperative or not installed, use check points at known distances along or near the runway. Each station should prepare a table or chart for conversion of observed values in feet to the corresponding reportable RVV values in miles.

3.16 RVR Preliminary Procedures. Observers must have the following knowledge.

a. (WB, FAA) Which recorder indicates RVR values at the approach end of the designated RVR runway.

b. The location of all the other RVR equipment on the airport and the relation of RVR sensors and readouts to the runway approaches.

c. The RVR category minima for all RVR runways.

3.16.1 RVR Observational Procedures. Check the designated RVR runway recording equipment frequently and when the criteria for making local and longline dissemination of RVR are met report the 1-minute and 10-minute values of RVR for the designated runway.

3.16.1.2 (WB) If the highest value for the designated RVR runway is below the authorized category minima, or is not available (Rnn(d)VRNO), encode, in addition to the data for the designated RVR runway, the 10-minute extremes from a secondary RVR runway. If a secondary RVR runway cannot be selected, send only the data from the designated RVR runway.

3.16.2 RVR Determination.

3.16.2.1 One-minute RVR Values. Nominal 1-minute values of RVR are based on the current runway light setting. These values are considered to be valid only for immediate use and are used only for local air traffic.

3.16.2.2 Ten-Minute RVR Values. Ten-minute values of RVR are considered to be more representative for periods greater than five minutes after observation and are used for longline transmission. These values are based on the following criteria:

a. (WB, FAA) Ten-minute extreme values (lowest and highest) of RVR are determined by selecting the values indicated on the recorder chart and converting to hundreds of feet by using table A3-11A, B, or C as appropriate. Values based on light setting 5 will always be used regardless of the light setting actually in use.

b. (AF) Ten-minute mean values are based on the highest available runway light setting of the airport.

3.16.2.3 Manually Computed One-Minute RVR Means. Because of lag in the transmissometer recorder system, the instantaneous indications on the recorder trace or on the transmission indicator dial may be considered as nominal 1-minute means of atmospheric transmission. These indications can be converted directly to runway visual range equivalents whenever the appropriate runway light setting and day or night condition are known. This computation is made by using the appropriate table A3-11A, B, or C. Apply background corrections to the transmisivity value before entering the table.

3.16.3 Discontinuance of RVR. Discontinue RVR observations whenever it is determined from a reliable source that the indicated value differs by more than 400 feet from actual conditions within the area of the transmissometer.

3.16.3.1 (AF) Also discontinue RVR observations when HIRL settings of 3 or higher are not available.

3.16.4 (WB, FAA) Emergency Local Dissemination. When all readouts used by traffic control personnel are inoperative weather station personnel will;

a. Relay RVR and/or RVV information to traffic control personnel as long as weather station equipment is known to be operating correctly (and, in the case of RVR, the high intensity runway lights are on a light setting of 3 or higher).

b. Base RVR values on light setting 5 when an operating computer readout is not available and the control tower has not specifically requested data for a lower light setting.

3.17 (WB, FAA) Emergency Reporting of Runway Visibility and Runway Visual Range. During periods when criteria for reporting RVR or RVV are met and all tower readouts of runway visibility and/or RVR are out of service but weather station readouts or recorders are operating, the weather station will relay to the tower, by graphic transcription or other available means, appropriate values of RVV and/or RVR. All values disseminated to the tower in accordance with these instructions should be recorded and the record maintained for 90 days. Any record such as telewriter or voice tapes will serve this purpose. As a minimum, this information will be disseminated as soon as possible whenever the RVR and/or RVV has dropped below the lowest landing minimum or, if below, has increased to equal or exceed the lowest landing minimum. Additional criteria may be used at local discretion.

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along with the noon GMT position when the barogram is removed. The barograph is not used to obtain any pressure values. However, the barograph trace is used to determine the appropriate 3-hour pressure change characteristic.

3.5.3 (N) The aneroid barometer shall be compared frequently with a mercurial barometer at designated Naval Weather Service Command units ashore. Pressure should be reduced to sea level when the compared barometers are not at the same elevation (to the nearest foot). In the comparison, care should be taken that the comparative readings are made simultaneously and during a period when pressure tendency is steady.

3.5.4 (WB) The aneroid barometer shall be compared immediately before and after each patrol in accordance with the instructions in Federal Meteorological Handbook No. 8, Barometry, section 6.9.1.

3.5.5 Sea-Level Pressure. The corrected aneroid barometer reading is reduced to sea-level pressure by multiplying 0.001 in. (.037 mb) by the height in feet of the barometer above the ship's mean waterline and adding this value to the corrected aneroid reading in inches (or mb). This value may be included in the posted correction if desired. However, station pressure will then be determined by multiplying the factor by the barometer height and subtracting the value obtained from the corrected barometer reading.

3.5.6 (N) Altimeter Setting. On Naval ships from which aircraft are operating, obtain the altimeter setting by applying a constant correction to the corrected (for station pressure) aneroid barometer reading. Subtract 10 ft. from the barometer height above the ship's mean waterline and multiply the height obtained by a factor of 0.00108 inches of mercury. Add this value to the corrected station pressure and round off to the nearest 0.01 inch to obtain the altimeter setting.

EXAMPLE:

Given:	Aneroid Barometer Height	45 feet
	Aneroid Barometer Reading	29.98 inches
	Posted Correction	.015 inches
	Corrected Station Pressure	30.000 inches

Computation of Constant

a. 45 - 10 = 35 feet
b. 35 x 0.00108 = 0.0378 rounded to 0.038
c. 30.000 +0.038 = 30.038
d. Altimeter setting = 30.04.

5. Dissemination of Observations.

5.1 General.

5.1.1 (N) NAVWEASERV COM INST 4140.1, Navy Meteorological Support Manual and NAVWEASERV COM INST 5400.1, Manual of the Naval Weather Service Command provide instructions on the observational program and weather message transmission schedules for Navy ships.

5.1.2 (WB) Completed hourly synoptic observations will be delivered promptly to the communicator addressed METEO WASHDC.

5.1.3 (WB) Special observations taken in response to requests from aircraft contemplating ditching will be prepared in plain language for immediate transmission to the aircraft. When language difficulties are anticipated, "Q" code may be used to identify the following elements. The observation will be completed as the next hourly synoptic observation after dissemination and a note shall be entered in column 24 giving the time in hours and minutes of the special observation. Such plain language reports shall include:

a. Surface Wind. True direction in degrees, speed in knots

b. Swell. Length, height and speed of swell and the direction in degrees from which swell is coming

c. Wind Waves. Same data as b. for wind waves

d. Prevailing Visibility. In nautical miles

e. Present Weather.

f. Low Cloud Layers. Amount and height of base of each C_L cloud layer

g. Sea-Level Pressure. To the nearest .005 in.

h. Remarks.

5.2 (WB) Monthly Means. Monthly means (TEMP SHIP) will be prepared and transmitted to METEO WASHDC on the first day of each month by the OSV which is on station in accordance with instructions contained in the Weather Bureau Operations Manual (WBOM, Vol. 3, F-21).

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6. Disposition of Forms.

6.1 (N) Marine Observational Records. Forward surface observations in accordance with instructions on OPNAV Form 3140-10 (A).

6.1.1 OPNAV Form 3140-10 (A). This form will be prepared as of the last day of each month in accordance with the instructions contained thereon. It will be submitted with observational records for the month ending on that date.

6.2 (WB) Marine Observational Records. At the end of each patrol, forward completed forms MF1-11 and WB Form 455-12 to the supervising weather patrol office for forwarding to the National Climatic Center. Enclose two copies of a letter of transmittal, listing the records forwarded indicating the range of dates. One copy will be returned to the weather patrol office by NCC as a receipt.

* 6.2.1 Preparation of WB Form A-1. Prepare this form:

a. Annually from each ship in the program.

b. Whenever a ship comes into the program for the first time.

c. Whenever a change in instrumentation is made. (This does not mean instrument replacement, only a change in type, e.g., SPS-29 to SPQ-10 or F420 to Aerovane, etc.)

d. Whenever an instrument having a documented elevation is moved to a different elevation

Under "station" enter the name of the ship. Enter "OSV" under "type." Enter the letter designator of the ocean station under "location." Fill in the appropriate data under parts 1, 2, and 3 in accordance with instructions in WBOM Chapter A11. In part 4, enter the date and port of departure, the date and time the ship went on and off station, and the date and port of return.

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Table A13-4. Temperature Conversion, Fahrenheit to Celsius

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
+100	+37.8	+37.8	+37.9	+37.9	+38.0	+38.1	+38.1	+38.2	+38.2	+38.3
99	37.2	37.3	37.3	37.4	37.4	37.5	37.6	37.6	37.7	37.7
98	36.7	36.7	36.8	36.8	36.9	36.9	37.0	37.1	37.1	37.2
97	36.1	36.2	36.2	36.3	36.3	36.4	36.4	36.5	36.6	36.6
96	35.6	35.6	35.7	35.7	35.8	35.8	35.9	35.9	36.0	36.1
+95	+35.0	+35.1	+35.1	+35.2	+35.2	+35.3	+35.3	+35.4	+35.4	+35.5
94	34.4	34.5	34.6	34.6	34.7	34.7	34.8	34.8	34.9	34.9
93	33.9	33.9	34.0	34.1	34.1	34.2	34.2	34.3	34.3	34.4
92	33.3	33.4	33.4	33.5	33.6	33.6	33.7	33.7	33.8	33.8
91	32.8	32.8	32.9	32.9	33.0	33.1	33.1	33.2	33.2	33.3
+90	+32.2	+32.3	+32.3	+32.4	+32.4	+32.5	+32.6	+32.6	+32.7	+32.7
89	31.7	31.7	31.8	31.8	31.9	31.9	32.0	32.1	32.1	32.2
88	31.1	31.2	31.2	31.3	31.3	31.4	31.4	31.5	31.6	31.6
87	30.6	30.6	30.7	30.7	30.8	30.8	30.9	30.9	31.0	31.1
86	30.0	30.1	30.1	30.2	30.2	30.3	30.3	30.4	30.4	30.5
+85	+29.4	+29.5	+29.6	+29.6	+29.7	+29.7	+29.8	+29.8	+29.9	+29.9
84	28.9	28.9	29.0	29.1	29.1	29.2	29.2	29.3	29.3	29.4
83	28.3	28.4	28.4	28.5	28.6	28.6	28.7	28.7	28.8	28.8
82	27.8	27.8	27.9	27.9	28.0	28.1	28.1	28.2	28.2	28.3
81	27.2	27.3	27.3	27.4	27.4	27.5	27.6	27.6	27.7	27.7
+80	+26.7	+26.7	+26.8	+26.8	+26.9	+26.9	+27.0	+27.1	+27.1	+27.2
79	26.1	26.2	26.2	26.3	26.3	26.4	26.4	26.5	26.6	26.6
78	25.6	25.6	26.7	25.7	25.8	25.8	25.9	25.9	26.0	26.1
77	25.0	25.1	25.1	25.2	25.2	25.3	25.3	25.4	25.4	25.5
76	24.4	24.5	24.6	24.6	24.7	24.7	24.8	24.8	24.9	24.9
+75	+23.9	+23.9	+24.0	+24.1	+24.1	+24.2	+24.2	+24.3	+24.3	+24.4
74	23.3	23.4	23.4	23.5	23.6	23.6	23.7	23.7	23.8	23.8
73	22.8	22.8	22.9	22.9	23.0	23.1	23.1	23.2	23.2	23.3
72	22.2	22.3	22.3	22.4	22.4	22.5	22.6	22.6	22.7	22.7
71	21.7	21.7	21.8	21.8	21.9	21.9	22.0	22.1	22.1	22.2
+70	+21.1	+21.2	+21.2	+21.3	+21.3	+21.4	+21.4	+21.5	+21.6	+21.6
69	20.6	20.6	20.7	20.7	20.8	20.8	20.9	20.9	21.0	21.1
68	20.0	20.1	20.1	20.2	20.2	20.3	20.3	20.4	20.4	20.5
67	19.4	19.5	19.6	19.6	19.7	19.7	19.8	19.8	19.9	19.9
66	18.9	18.9	19.0	19.1	19.1	19.2	19.2	19.3	19.3	19.4
+65	+18.3	+18.4	+18.4	+18.5	+18.6	+18.6	+18.7	+18.7	+18.8	+18.8
64	17.8	17.8	17.9	17.9	18.0	18.1	18.1	18.2	18.2	18.3
63	17.2	17.3	17.3	17.4	17.4	17.5	17.6	17.6	17.7	17.7
62	16.7	16.7	16.8	16.8	16.9	16.9	17.0	17.1	17.1	17.2
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